Commercial Banking in Metropolitan Areas: A Study of the Chicago SMSA

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Commercial Banking in Metropolitan Areas: A Study of the Chicago SMSA

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ABSTRACT

COMMERCIAL BANKING IN METROPOLITAN AREAS: A STUDY OF THE CHICAGO SMSA

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Urban location theory has been used to develop models of land use, rent, wage rates and price variation throughout metropolitan areas. However, most spatial models of cities and studies of the suburbanization process assume that capital funds and financial services are available at all locations at the same price. Although this assumption simplifies spatial analysis, it is generally not valid. The effects of neglecting the spatial distribution of this important factor of production depend upon its spatial concentration and price variation.

The purpose of this study was to develop a model of the distribution of commercial banking activity within metropolitan areas and to determine if the model could be used successfully to describe present and future patterns of commercial bank activity. The model was developed using the well-known theories of consumer and business maximizing behavior and spatial economic theory. Demands for services of commercial banks were hypothesized to depend upon charac-

teristics of the residents, working force, and businesses in the neighborhood of the bank and adjacent subareas. Characteristics of adjacent subareas entered the demand equations using a form of the demographic potential variable defined by Stewart. The supply of bank services was derived from banks' production functions and factor costs. The model was then completed through market clearing and regulatory constraints.

Data on costs of bank inputs were not available and so the entire model could not be estimated. Demand equations were estimated for five bank services -- real estate loans, commercial and industrial loans, loans to individuals, savings deposits, and IPC demand deposits -- and, as a proxy for total services demanded, total assets. These demands were estimated for banks in 102 suburbs and community areas of Chicago for the years 1962 and 1968.

Empirical results showed that population, median family income, the proportion of residents 18 to 64 years of age, and nonmanufacturing employment were positively related to demands for all six services. Employment in adjacent areas had a direct effect on demands for all services, except savings deposits, implying that the service area of a bank extends beyond its immediate neighborhood. This result was confirmed further by the inverse relationship between demand and the number of competing banks in adjacent areas. In addition, large banks attracted a significant number of customers from a wider geographic area. The ratio of employment to population in a subarea had a significant negative effect in some demand equations. This agrees with previous surveys of bank customers which indicated that persons tend to patronize banks closer to their homes than to their workplaces. The percentage of population nonwhite had an inverse relation with savings account demand.

Demands for services of banks increased with their distance from the central business district (CBD). This implied that while larger CBD banks may provide a wider variety of services and engage in more extensive advertising campaigns, customers' preferences for a convenient banking source and increasing travel costs cause customers to substitute services of CBD banks for those of local banks as distance to the CBD rises. Results also implied that central city banks continued to grow despite the exodus of customers from their service areas. This agrees with customer surveys which found that customers often retain their old banking connections, at least in short-run, when they move within a metropolitan area.

Coefficients of demand equations estimated separately for central city and suburban areas were not statistically equal. Results implied this was because suburban demands had not reached long-run equilibrium levels, but were adjusting with a lag to new spatial locations of economic units, while central city banks experienced more stable long-run relations.

CHAPTER I

INTRODUCTION

Purpose of the Study

The large scale suburbanization of households and business firms that has marked the growth patterns of metropolitan areas in the last twenty-five years has caused much concern for the future of central cities. Urban renewal efforts have been undertaken, with varying degrees of success, to maintain the downtown and older areas of central cities as the commercial and entertainment centers of the metropolitan area that they traditionally have been. The forces that led to suburbanization, however, may be creating a new role for central business districts and central cities.

Urban location theory has been used to develop models of land use, rent, wage rates and price variation throughout metropolitan areas. However, most spatial models of cities and studies of the suburbanization process assume that capital funds and financial services are available at all locations at the same price. Although this assumption simplifies spatial analysis, it is generally not valid. The effects of neglecting the spatial distribution of this important factor of production depend upon its spatial concentration and price variation.

Prevailing areal patterns of commercial bank location and interest rates arise partially from the fact that major financial institutions -- commercial banks, savings and loan associations, mutual savings banks, and trust companies -- are not permitted to freely enter markets, merge, or engage in price competition. Various regulatory agencies are charged with approving new charters and mergers and establishing interest rate ceilings. In making their decisions, the agencies should have a concept of banking market areas and the resulting spatial location and price patterns. Unfortunately, much of the regulatory agencies' decision making is done on an *ad hoc* and/or political basis. While some studies of bank market areas and price variation have been conducted, they have not been incorporated into the types of models used by urban economists and geographers which can become decision making tools. The purpose of this study is to develop such a model of commercial banking within metropolitan areas.

Within the framework of this model, the following questions are considered:

1. Which locational factors are the principal determinants of commercial bank size?

2. Do local economic factors have varying effects on the amounts of the different services provided by commercial banks?

3. What will be the future spatial pattern of commercial bank activity within metropolitan areas?

4. What is the relationship between the spatial pattern of banking activity and the relocation of other economic units?

5. To what extent can the model developed here assist bankers and regulatory agencies?

The remainder of this chapter outlines previous studies of suburbanization of economic activity, with special attention given to studies of financial institutions. A model of commercial banking within a metropolitan area is developed in Chapter II. The methodology and problems involved in estimating the model are discussed in Chapter III. Chapter IV begins with an overview of the Chicago Standard Metropolitan Statistical Area (SMSA). The results of demand equations estimated for the Chicago SMSA for the years 1962 and 1968 are then given. The implications of the results are developed in Chapter V to describe the evolving distribution of commercial bank services throughout metropolitan areas in view of continuing changes in the location of other economic units. The model's applicability in making bank location decisions is also discussed.

Commercial Banking in Metropolitan Areas

The geographic area of the nineteenth century city was limited by intra-city transportation and communication facilities.[1/]

1/ For a discussion of the effects of improved transportation and communication technologies on the location of manufacturing activity within cities see Leon Moses and Harold F. Williamson, Jr., "The Location of Economic Activity in Cities," American Economic Review, Vol. LVII, No. 2 (May 1967), pp. 211-222.

Horse-drawn carts and trolleys were used to move goods and people within cities, while the railroad was quickly transporting them between cities. The telegraph delivered messages between cities faster than a man could within a city. To economize on intra-urban communication costs, firms tended to locate close to their customers, suppliers, and the rail terminal. This concentrated cluster of businesses formed the heart of the nineteenth century city.

Cities that developed during this period tend to have well defined financial districts in their downtown areas. Located within these financial districts are stock and commodity exchanges, clearing houses, and the home offices of large commercial banks, insurance companies, and stock brokerages. These firms were originally brought together because of the large volumes of money, check, paper, and information transfers that occurred among them daily, and because these areas were easily accessible to the large supply of workers required in these labor intensive industries.2/ In his study of New York City, Chinitz found that industries locate in central, higher rent areas of cities to serve customers which are concentrated in the immediate neighborhood or to realize economies of agglomeration, i.e., external

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2/ To obtain sufficient passenger volume to meet the high fixed costs of mass transit systems, routes generally radiated from the city core. Service between two sites elsewhere in the city was generally not available.

economies arising from proximity to competitors or suppliers.3/ In his discussion of Chinitz's findings, Clark notes that "In this connection we may...mention all forms of finance, which are also dependent on external economies, and in addition need frequent and rapid opportunities for face to face discussion with those with whom they have to do business."4/

The relative importance of the above locational factors induced main offices of commercial banks to remain in the financial district despite the growth of outlying areas of the city. A study of New York City in the 1920s concluded that, "Despite the northward flow of population and of various commercial interests, the heart of the banking district has remained in Wall Street."5/ However, branches were established throughout the city in order "to retain the business of clients moving outside the financial district and to obtain a share of the rapidly growing new business."6/

3/ Benjamin Chinitz, Freight and the Metropolis (Cambridge, Mass.: Harvard University Press, 1960), pp. 140-142.

4/ Colin Clark, Population Growth and Land Use (New York: St. Martin's Press, 1967), p. 359.

5/ Donald H. Davenport, Lawrence Morton, and Ralph W. Roby, "The Retail Shopping and Financial Districts in New York and Its Environs," The Regional Plan of New York and Its Environs, Economic Series Monographs Numbers 10 and 12 (1927), p. 35.

6/ *Ibid.*, p. 36.

Modern technology has minimized the relative importance of the communication factors that originally concentrated banks in the central city. The telephone and teletype permit rapid financial transactions and information flows among different locations. Officers of financial institutions can keep in touch by telephone, no matter where their offices are located. Armored trucks and cars easily transfer currency and checks between banks and customers. The growth of credit cards and the prospects of a checkless society will decrease the physical interchange of money between banks. A growing number of households use bank-by-mail services and seldom visit their banks. In addition, the pace of suburbanization, which had slowed during the Great Depression and World War II, quickened in the postwar period and increased the demands for financial services in outlying areas.

Suburbanization of Metropolitan Economic Activity

The natural population growth and migration of rural population to cities in the nineteenth century pushed settlement beyond the old city limits. However, the relatively high transportation and communication costs limited the geographic expansion of cities and kept central city population density high. Not until the introduction of the truck, automobile, and telephone were firms and households able to take advantage of lower land, labor, and input costs in outlying areas. These lower factor costs had previously been more than offset by the costs of moving goods to the plant and then to market. The new communication technology, "changed the nature of urban space, allowing greater distances to be covered and particularly the development of favored sites -- parts of the city [chosen] more on the basis of their intrinsic natural and cultural characteristics, and less because of their location or situation."7/

The rate of suburbanization increased sharply after World War II and greatly altered the distribution of income and wealth within metropolitan areas. Minority and low-income persons became an increasing proportion of the population of central cities as the middle- and upper-classes moved to more desirable sites in the suburbs. Business firms left the central cities to take advantage of lower suburban rent and input costs, to avoid the traffic congestion and higher insurance costs associated with a central city location, and to be closer to their principal customers that had moved to the suburbs.

Financial firms in older areas of the city have also had their customers move to the suburbs. New residents in the older areas do not have the same levels of wealth as their predecessors and many shops have remained empty. Thus, the demands for services of financial institutions in these older areas have declined. Many of these firms have been permitted to close, relocate, or merge

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7/ Edward L. Ullman, "The Nature of Cities Reconsidered," in Urban Economics: Theory, Development, and Planning, ed. by William H. Leahy, David L. McKee, and Robert D. Dean (New York: The Free Press, 1970), p. 11.

with firms in growing areas. However, the loss of neighborhood credit institutions may have further increased the costs of attracting investment capital for the renovation of these declining areas.

Central city banks have become increasingly aware of the locational advantages of suburban competitors. Despite the increased use of bank-by-mail services, armored cars, etc. "convenience" remains a primary factor in choice of bank by households and small businesses. For households, "convenience" may mean ample parking and drive-up facilities, longer banking hours, or the bank closest to home, place of work, or shopping. For business firms, convenience factors include night depository services and short trips to deposit and receive cash and currency.

Results of a survey of central Bucks County, Pennsylvania, indicate the importance of "convenience" in choice of bank by households.[8/]

8/ Robert D. Bowers, "Businesses, Households, and Their Banks," Federal Reserve Bank of Philadelphia Business Review (March 1969), pp. 14-19.

TABLE 1

FACTORS DETERMINING HOUSEHOLD CHOICE OF BANK
WHERE CHECKING ACCOUNT MAINTAINED

Reason	Percent of Households Citing Reason
Convenient to home	47 %
Convenient to work	11
Friendly service, like bank	10
Family always used it	6
Location originally convenient and kept bank after move	4
Convenient to shopping	4
Recommended by friend, etc.	4
Have mortgage or loan there	2

Source: Bowers, "Businesses, Households and Their Banks," p. 18.

In a study of Elkhart, Indiana, two-thirds of the firms and three-fourths of the households viewed their primary bank as the most convenient.[9/] Other surveys of bank customers have given similar results.[10/]

9/ George G. Kaufman, Customers View Bank Markets and Services: A Survey of Elkhart, Indiana (Chicago: Federal Reserve Bank of Chicago, 1967), p. 13.

10/ See George G. Kaufman, Business Firms and Households View Commercial Banks: A Survey of Appleton, Wisconsin (Chicago: Federal Reserve Bank of Chicago, 1967); George G. Kaufman and Roberta K. Detz, Customers View a Bank Merger: A Resurvey of Elkhart, Indiana (Chicago: Federal Reserve Bank of Chicago, 1969); Lynn A. Stiles, Businesses View Banking Services: A Survey of Cedar Rapids, Iowa, Staff Economic Study No. 33 (Washington: Board of Governors of the Federal Reserve System, 1967).

Unit banks in the central city have no direct means of offering convenient banking to suburban customers except through bank-by-mail services. However, with regulatory agency approval, branch banks can establish and discontinue branches as the location of their customers changes. In another study by this author, deposit data revealed that large banks in the Eighth Federal Reserve District experienced much more rapid growth at their branches than their central city offices and that unit banks which were restricted to operations from home offices in the CBD averaged much slower total growth than these branch banks.[11/] The rapid expansion of bank holding companies during the 1960s, especially among CBD banks in unit banking states, is an indication of the importance central city bankers have placed on obtaining offices in growing areas.

While convenience factors may provide suburban banks with competitive advantages in meeting demands for some financial services, large banks continue to attract customers through their ability to provide more specialized services. Larger banks can conduct advertising campaigns on a scale which reach residents of the entire metropolitan area. Major banks in many central business districts have erected office buildings prominently dominating the

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11/ Susan Schmidt Bies, "Determinants of Commercial Bank Growth," Federal Reserve Bank of St. Louis Review, Vol. 53, No. 12 (December 1971), pp. 11-18.

city skyline to make their presence more obvious. Also since customers requiring more specialized financial services and large loans cannot efficiently use the services of small banks, they will patronize large banks, regardless of their location.

On the cost side, incentives may be increasing for large CBD banks to move to the suburbs along with their customers. Financial firms are labor intensive, and wages tend to be lower in outlying areas.

> "At one time, the great bulk of [financial institution] employees came from locations readily accessible to the financial district. Over time, this convenience factor has been whittled away by the spread of the population and by radical alterations in transportation routes and methods."12/

In summary, cost advantages and growth of demand in outlying areas are providing banks with the same incentives to locate in the developing portions of the metropolitan area as those which have led to the suburbanization of other economic units. However, the speed of adjustment may be slow, especially for large CBD banks, because of their fixed capital investments in the financial district, the increased use of bank-by-mail services, and the relatively high proportion of their customers for whom size and not location is the important criterion in choice of bank.

12/ Sidney M. Robbins and Nestor E. Terleckyj, Money Metropolis: A Locational Study of Financial Activities in the New York Region (Cambridge, Mass.: Harvard University Press, 1960), p. 46.

Previous Studies of the Location of Financial Institutions

While many studies of the location of manufacturing and retail firms have been conducted, few have analyzed service establishments, especially financial institutions. The first major study of the suburbanization of service industries was conducted by Cuzzort.13/ Using 1939 and 1948 Census of Business data for 125 Standard Metropolitan Areas (SMAs) Cuzzort estimated service activity in the suburban ring of metropolitan areas by regressing percentage of SMA service receipts in the ring against: percentage of population in the ring and in rural portions of the SMA, percentage of workers employed in manufacturing, percentage of white collar residents in the ring, population density of the central city, SMA population, SMA median family income, and age of the SMA. Although the R^2 was relatively high, .84, only three variables had coefficients significant at the 95 percent confidence level (see Table 2).

13/ Raymond P. Cuzzort, Suburbanization of Service Industries Within Standard Metropolitan Areas, Scripps Foundation Studies in Population Distribution No. 10, (Oxford, Ohio: Miami University, 1955).

TABLE 2

PERCENTAGE OF SERVICE ESTABLISHMENT
RECEIPTS IN SUBURBAN RING
MULTIPLE REGRESSION RESULTS FOR 125 SMAs IN 1948

Independent Variable	Estimated Coefficient
Constant	-13.62
Percentage of SMA Population in Ring	.8212*
Percentage of Population in Rural Areas	-.3735*
Median Family Income, SMA	.0264*
Percentage Employed in Manufacturing, SMA	.0055
Central City Population Density	.0042
SMA Population	-.0074
Percentage of White Collar Residents in Ring	-.0705
Age of SMA (decades)	-.0119
R	.91
R^2	.84
Standard Error of Estimate	4.8 %

* Significant at 95 percent confidence level

Source: Cuzzort, Suburbanization, p. 35.

Suburban sales receipts increased with median family income, indicating that services are "normal" goods in the economic sense.[14/] The proportion of SMA population in the suburban ring

14/ George J. Stigler, The Theory of Price (3rd ed.; New York: The Macmillan Company, 1966), p. 33.

had a large positive effect on service firm receipts. This was expected, since convenience is an important factor in shopping for services. Percentage of the population in rural areas had a negative relation with suburban service receipts. Cuzzort's explanation of this was based on the hypothesis that rural residents go to the central city rather than the suburbs to obtain services. Since they must travel anyway, a trip to the central city can accomplish several purposes, because of the wider variety of service, retail, and entertainment firms located there.[15/] Cuzzort also found business services to be less decentralized than personal services, and that "the problem of explaining ...[changes] in service activity taking place within the various component parts of [metropolitan areas] proved to be more difficult than...explaining...static conditions."[16/]

While Cuzzort's work greatly improved our insights into the intraurban locational pattern of service industries, it has several weaknesses. First, it is not altogether clear what the hypothesized relation between SMA median family income and suburban service sales should be since incomes vary throughout the SMA. The same comment can be made with regard to percentage of SMA employment in manufacturing industries. Secondly, Cuzzort divides the SMA into four regions: CBD, central city, suburban ring, and

15/ Cuzzort, Suburbanization, p. 35.

16/ Ibid., p. 48.

rural ring. While these may be fairly homogeneous units in smaller SMAs, in larger metropolitan areas population density, types of industry, income, etc. can vary widely within each of these broad regions. Finally, Cuzzort was faced with the problem of describing the operations of firms which produce no easily defined physical output. The spatial variation in service establishments, employment, and receipts provide different measures of concentration.

Cuzzort was aware of these problems, but lacked data to refine his analysis further. An important conclusion of his, which was reinforced by the results of this study, is "that it is necessary to deal with change in a particular part of the [SMA] in terms of conditions that occur within that area."[17/]

While Cuzzort's data did not cover financial establishments, Artle included the number of commercial and savings banks in his study of the Stockholm metropolitan area.[18/] Using a grid system, Artle's data were collected for subareas in the Stockholm metropolitan area. His results indicated that the total number of commercial and savings

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17/ Ibid.

18/ Roland Artle, Studies in the Structure of the Stockholm Economy, FFI Report No. 57 (Stockholm: The Business Research Institute at the Stockholm School of Economics, 1959).

banks in subarea i were determined by the following regression equation:[19/]

$$\text{Number of banks}_i = -.07 + .00\ \text{Population}_i + .41\ \text{Total Employment}_i$$

The population coefficient was not significantly different from zero, but total employment had a significant positive effect on the number of banks in an area. These were the only exogenous variables tested and no summary statistics for the regression were given.

One of the difficulties in Artle's study was that he concentrated on the number of establishments. From research on American financial institutions it is well known that banks operate with only minimal economies of scale through a wide size range. Number of banks is not clearly related to volume of deposits, loans, income, or bank employment. Thus, his use of the number of banks to measure locational characteristics of banks may explain his poor results.

Tulpule used employment data in his study of the distribution of service industries in Greater London.[20/] His study concen-

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19/ *Ibid.*, p. 129.

20/ A. H. Tulpule, "Towards an Integrated Model of Distribution of Service Employment in the Non-Central Areas of Greater London," *Bulletin* of the Oxford University Institute of Economics and Statistics, Vol. 30, No. 3 (August, 1968), pp. 207-229.

trated on the noncentral areas, where demand arising outside the immediate area of the firm was expected to be less. He hypothesized that population, employment, and industry within a borough determined the level of local service industry employment.

Tulpule found that local manufacturing employment created less demand for services than the same level of nonmanufacturing employment. This he explained by the nature of work in manufacturing firms. Some employees begin and leave work at hours when service establishments are not open. In addition, manufacturing employees generally do not have as long a lunch hour nor do they leave the plant for lunch, so it is difficult for them to patronize service firms during working hours.

Tulpule's empirical results for total service employment indicated a significant positive effect on service employment by population, manufacturing, and nonmanufacturing employment. However, when he used employment in financial firms as the dependent variable, he deleted manufacturing employment and weighted population by the socio-economic level of the residents. He deleted manufacturing employment because "relatively few workers [in these industries] have bank accounts," their wages are paid in cash, and the firm's banking activity is handled by the home office.[21/] This, would not be true of American firms, however. Almost all workers are paid by

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21/ *Ibid.*, p. 218.

check and, while major loans are negotiated by the home office, local plants generally maintain payroll and petty cash accounts at nearby banks.

Multiple regressions were run across 75 boroughs of London for both 1951 and 1961. Using employment in financial services, y, as the dependent variable, Tulpule's results were as follows:22/

(1951) $y = -261.58 + .00234$ Weighted Population
$R = .485$ $+ .0373^{*}$ Nonmanufacturing Employment

(1961) $y = -308.52 + .01334$ Weighted Population
$R = .544$ $+ .0386^{*}$ Nonmanufacturing Employment

* Significant at 95 percent confidence level

For both years, the population coefficient was not significantly different from zero, but the positive coefficient on nonmanufacturing employment was significant. Tulpule concluded that the "general scheme of analysis is not very satisfactory for this industry and a more sophisticated model is necessary to study the distribution of financial activities."23/

A slightly different approach was used by Davidson in his attempt to obtain estimates of demand for bank services which could

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22/ Ibid.

23/ Ibid., p. 219.

be used in locating branch offices.[24/] Unlike the studies previously discussed, he included a spatial competition variable, the number of competing offices. This variable was hypothesized to have a negative effect on the level of deposits at a given branch. A branch's service area boundaries were defined "by the perpendicular bisectors of the straight lines drawn between the branch location and all surrounding bank offices," except those which are within the immediate 2 or 3 block area of the branch in question.[25/] These neighborhood banks were the branch's competitors.

Using observations on 17 branches he regressed both the number of checking accounts, P(check), and savings accounts, P(save), against: population in the service area, N; retail sales in the service area, S, as a surrogate for employment; average family income in the service area, Y; and number of competing bank offices, C. His results were as follows:[26/]

24/ Frederick Davidson, "Demand Forecasting for Branch Bank Location Analysis," (unpublished Ph.D. dissertation, University of Pittsburgh, 1968).

25/ *Ibid.*, p. 37. This simple definition of a market area is based on the assumption that travel costs are the same in all directions. The more general description of the market boundary of two firms, first stated by Frank A. Fetter, is the hyperbolic curve defined as the locus of points where "the difference between [freight costs] from the two markets is just equal to the difference between the market prices." See "The Economic Law of Market Areas," reprinted in *Spatial Economic Theory*, ed. by Robert D. Dean, William H. Leahy, and Donald L. McKee (New York: The Free Press, 1970), pp. 157-164.

26/ *Ibid.*, pp. 55-56.

$$P(check) = -1204 + .1090^{*}N + 69.92^{*}S + .2501^{*}Y - 186.8C$$
$$R = .9396$$

$$P(save) = 3003 + .1308^{*}N + 82.35^{*}S - .2069Y - 101.1C$$
$$R = .7949$$

* Significant at 95 percent confidence level

As hypothesized, population and retail sales were both positively and significantly related to number of checking and savings accounts. Income had the expected significant positive effect on checking accounts. The negative income effect Davidson hypothesized for savings accounts was not significant, but the sign on the coefficient was correct.

While the bank competition variable did not have a significant coefficient, this may reflect the definition of competitors rather than the lack of influence of competition on demand for deposits at a bank. Banks compete with offices beyond their immediate two or three block area, especially in metropolitan areas. Individuals view bank offices both near their homes and work places as convenient alternatives.[27/]

Davidson's overall results were much better than those of Tulpule or Artle, despite the small number of observations. A large part of this may be accounted for by his output measure -- number of accounts. Since banking does not require fixed propor-

27/ See page 9 above.

tions of labor inputs, the use of the unit of service, an account, is much closer to an accurate outnut measure in this service industry than are employment or number of banks.

In addition, Davidson recognized the multi-product nature of commercial banking. Number of banks or bank employees does not capture the fact that banks of the same total asset size may have quite different proportions of real estate, commercial, agricultural, or personal loans in their portfolios and different time and demand deposit mixes. Since these services are demanded by different customers and are likely to have different income elasticities, the spatial distribution for various services should be quite different.

A study of intraurban location of financial institutions in the City of Chicago was recently conducted by Kaufman and Detz (K-D)[28/] Their areal units of observation were the 76 community areas of Chicago defined by the University of Chicago on the basis of economic, ethnic, trade, and other neighborhood characteristics. The number of commercial banks, savings and loan associations, and currency exchanges in each area were explained by the characteristics of each subarea: population, population density, median family income,

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28/ George G. Kaufman and Roberta K. Detz, "A Profile of Banking in Chicago," (Staff Memoranda, Federal Reserve Bank of Chicago, November 1970).

percentages of population nonwhite and East European, ratio of employment to population, and retail sales per capita.

The only independent variables significant at the 95 percent confidence level were population, ratio of employment to population, and retail sales per capita (see Table 3).

TABLE 3

NUMBER OF COMMERCIAL BANKS, CITY OF CHICAGO
1960 MULTIPLE REGRESSION RESULTS

Independent Variable	Coefficient
Population	.019*
Employment/Population	.412*
Retail Sales Per Capita ($1,000s)	.317*
Population per acre	.011
Median family income ($1,000s)	.039
Percentage of Population Nonwhite	-.006
Percentage of Population East European	-.018
R^2 = .45	

* Significant at 95 percent confidence level

Source: Kaufman and Detz, "Banking in Chicago," Table 24.

K-D concluded that "...population within the area [was] by far the most important explanatory variable."29/

As with the studies previously discussed, K-D used only within area data. This varies with much of the research done on retail trade where the concept of potential demand is used. When the geo-

29/ Ibid., p. 14.

graphic size of the units of observation are small and are within a major city, where much commuting occurs through each area daily, persons and firms not living or working in a subarea may use the services of banks in that area. Thus, characteristics of surrounding areas can be expected to affect demand for services of banks in a given area.[30/]

In summary, previous studies of the intraurban distribution of financial services have been of limited value because of the absence of theoretical models of spatial demand and supply of bank services and the inability to obtain better data. The small amount of research done in this area may account in part for the lack of a more explicitly defined model of commercial banking in metropolitan areas.

The model developed in the next chapter incorporates urban location theory and concepts of bank output and operating policies arising from studies of commercial banks. The model is then tested using data on individual bank services, rather than the weaker gross output measures used in previous studies.

30/ This concept was used in the model developed in this study. See Chapter II.

CHAPTER II

A MODEL OF COMMERCIAL BANKING WITHIN A METROPOLITAN AREA

The model of commercial bank activity presented here is based on the maximizing assumptions which underlie all theories of economic behavior. The household's demands for services at various banks are determined by its preferences, income, prices of all goods, and the location of alternative banks. A business firm likewise obtains the optimum level of services as indicated by its production function, input and output prices, and bank locations. The bank itself is assumed to be a profit maximizer, at least within the limits of prevailing legal constraints. It holds the mix of loans and investments which maximizes long run profits and bids for deposits in a competitive market. The behavioral assumptions for households, businesses, and commercial banks are developed, in turn, in the following three sections of this chapter. The nature of bank competition is then described to complete the model.

In the model of commercial banking developed below, locations of economic units, income, production levels, transportation costs, and prices of nonbank goods and services are exogenous. These factors are determined outside of the model because commercial banks are primarily financial intermediaries: extending financial advice, loans, safekeeping facilities, and demand deposit services which facilitate monetary transactions. Customers' demands for these services are generally subordinate to their decisions to purchase current consumption goods and factor inputs or hold various forms of assets. Thus, we take the existing intraurban patterns of production, residence, wages, prices, and transportation as exogenous and concentrate on their relationship to commercial banking.31/

Household Demands for Bank Services

The traditional theory of consumer behavior is concerned with a "rational" economic being who chooses the goods and services to purchase on the basis of his preferences, prices, and his income. Since these transactions are made in a spaceless world, no mention of locations of stores, place of employment, or residence is needed. However, a consumer must not only decide how much of a given commodity he wishes to purchase but also where to purchase the item. When

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31/ While location and operating practices of commercial banks may have long run effects on the spatial form of metropolitan areas, measurement of such effects is beyond the scope of this paper. To the author's knowledge, no extensive study has been made of these possible long run effects.

residences, firms and market points are dispersed over a geographic area, costs of communication and transportation arise. These costs and the resulting disutilities of travel must, therefore, be included in a consumer decision model which recognizes the existence of a two dimensional world.

Assume that the consumer has preferences for the various goods and travel modes and these preferences define a utility function with continuous first and second order partial derivatives with respect to all variables. Since we are interested in the consumers' demands for the services of commercial banks, we will combine all other goods and services and the travel connected with them into a composite "good" X, which has a price P.

Let B_n^k represent the "amount" of service k purchased from banks in area n.[32/] Associated with B_n^k is a measure of travel necessary to obtain the bank service, T_n^k. A customer may travel to the bank from home or work or bank while shopping, and he can use several modes of transportation to obtain B_n^k, e.g. car, bus, mail, walking. To simplify the analysis, we will assume the consumer has chosen from among the transport alternatives facing him the mode he would use to go to each bank in the metropolitan area. His criteria for choice include monetary cost, time, discomfort, and frequency of

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32/ "Amount" will be defined below. See page 74 .

trips. He will choose the mode that affords the least disutility given its monetary costs, and a customer will travel to the bank only to obtain a service.

$$(2.1)\quad T_n^k = t_n^k(B_n^k);\ \frac{\partial T_n^k}{\partial B_n^k} \geq 0;\ T_n^k = t_n^k(0) = 0$$

where: $k=1,\ldots,K;K$ = number of bank services
$n=1,\ldots,N;N$ = number of subareas in the SMSA.

Also,

$$(2.2)\quad C_n^k = c_n^k(T_n^k);\ \frac{\partial C_n^k}{\partial T_n^k} \geq 0$$

where C_n^k is the total monetary costs associated with travel, T_n^k.

The household maximizes its utility function subject to its budget constraint:

$$(2.3)\quad L = U(B_1^1,\ldots,B_1^K;\ldots;B_N^1,\ldots,B_N^K;T_1^1,\ldots,T_1^K;\ldots;T_N^1,\ldots,T_N^K;X)$$

$$-\lambda\left(\sum_{n=1}^{N}\sum_{k=1}^{K} I_n^k B_n^k + \sum_{n=1}^{N}\sum_{k=1}^{K} C_n^k + PX - Y\right)$$

where I_n^k = price of service k at bank n [33/]

33/ It is recognized that customers are often charged on the basis of the amounts of all services they use. E.g., the stated interest rate on a loan may be lower because of higher average demand deposit balances. However, introduction of these "package" charges would only serve to complicate the analysis at this point without significantly increasing the information derived from the model. In addition, the limited data for use in the study rule out any indication of price. We will indicate later what effect any neglected price differential may have on our results.

Y = income of the household

λ = Lagrangean multiplier.

The first order conditions for utility maximization are:

(2.4a) $$\frac{\partial L}{\partial B_n^k} = \frac{\partial U}{\partial B_n^k} + \frac{\partial U}{\partial T_n^k}\frac{\partial T_n^k}{\partial B_n^k} - \lambda\left(I_n^k + \frac{\partial C_n^k}{\partial T_n^k}\frac{\partial T_n^k}{\partial B_n^k}\right) = 0$$

or, hereafter for brevity using the form $X_Y \equiv \frac{\partial X}{\partial Y}$:

$$U_B + U_T T_B - \lambda(I + C_T T_B) = 0$$

k=1,...,K;K = number of bank services available
n=1,...,N;N = number of subareas in the SMSA

(2.4b) $$\frac{\partial L}{\partial X} = \frac{\partial U}{\partial X} - \lambda P = U_X - \lambda P = 0$$

(2.4c) $$\frac{\partial L}{\partial \lambda} = \Sigma\ \Sigma\ I_n^k B_n^k + \Sigma\ \Sigma\ C_n^k + PX - Y = 0$$

Assuming $U_X>0$ and $P>0$, (2.4b) requires λ, generally interpreted as the marginal utility of income, to be positive.[34/] With $T_B>0$, and assuming that travel yields disutility, $U_T<0$, equation (2.4a) may be rewritten:

$$(2.5) \quad U_B - \lambda I = -(U_T T_B) + \lambda(C_T T_B) > 0$$

Households pay for loans, demand deposits, trust services, etc., so for these services $I>0$ and $U_B>0$, and, for (2.5) to hold, $U_B>\lambda I$. Households receive interest on time deposits, increasing their income and making $I<0$. Thus (2.5) will hold for time deposits if $U_B<0$. In a static model, such as the one developed here, any income not spent in the current period implies utility foregone and $U_B<0$. Savings are justified only in an intertemporal framework. The level of savings each year is determined by a process of utility maximization over time. Just as loans are taken to increase utility in the present, savings are a way of deferring spending to a period which will have a greater marginal utility of income because of a lower monetary income or increased consumption demands. In our static model, we assume these intertemporal decisions are made first, and then a period's budget is allocated among the various goods.

34/ See Paul A. Samuelson, Foundations of Economic Analysis (New York: Antheneum, 1965), p. 99.

It is very likely that the consumer's demands for some services at some (or all) banks will be zero. However, the individual's demand equations can be derived from (2.4).

$$(2.6)\quad hB_n^k = hB_n^k\,(\ldots,I_n^k,\ldots;\ldots,C_n^k,\ldots;P;Y).$$

$$k=1,\ldots,K$$
$$n=1,\ldots,N$$

$$X = x(\ldots,I_n^k,\ldots;\ldots,C_n^k,\ldots;P;Y)$$

Assuming diminishing marginal utility of bank services, $U_{BB}<0$, and travel, $U_{TT}<0$,[35/] the signs of the partial derivatives of (2.6) are implied from (2.5). An increase in the price of a bank service will decrease quantity demanded of that service, and customers will use services of other banks who do not raise their prices. The effect on demand for other types of bank services will depend on their respective elasticities of substitution. An increase in transportation costs to obtain a given service at a bank will affect demand for a bank's service in the same direction as a price change.

An increase in price, P, of the composite good will affect demands for bank services depending on the degree of complementarity between the good and a bank service. A price rise that decreases

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35/ Recall that utility and marginal utility of travel, U_T, are negative.

purchases of goods will decrease the demand for checking account services. The price rise will increase savings demands and decrease loan demands if it is viewed as a temporary rise, for there will be intertemporal substitution effects to defer spending to a time when prices return to expected levels. A permanent price rise may increase, decrease, or not affect current demands for savings and loans, depending upon the relative strength of the income and substitution effects on the goods these funds will be used to purchase.

An income rise should increase demands for bank services, but at very high income levels time deposits may become inferior goods. After time deposits reach a certain level, the household may be more willing to place additional funds into higher risk investments that have greater rates of return.

The total demand by households for a given bank's services can be obtained by summing (2.6) over all households. Since convenience to home is an important criterion in choice of bank, aggregate demand should depend upon the population of the bank's subarea and that of adjacent areas.[36/] In addition, since families are not identical and residents commute to various places to work and shop, it is necessary to include in the aggregate demand equation factors

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36/ While some demand originates from households in other metropolitan subareas, this demand should be small relative to local demand since more convenient banks are probably available to distant residents.

that may lead one household to demand more bank services than another family with similar income, residence, and work site. The variables hypothesized to effect demand are: age of household members, work place, bank competition, ethnic background, and stability of population and employment in the area.

The demands for various bank services vary over the life cycle. Young families hold mortgage loans, and begin saving money to pay for the education of their children. After retirement, savings are depleted and loan repayments completed. Thus the younger the family, the greater should be their demands for mortgage and installment loans, and time deposits should be highest as they approach middle age.[37/]

Savings habits and consumption patterns are learned from the family and social group. Thus, racial composition of the population may affect demands for bank services.[38/]

37/ Income elasticities less than one for both demand and savings deposits and these relations between age, borrowing, and forms of wealth holding were indicated in a study by Dorothy S. Projector and Gertrude S. Weiss, Survey of Financial Characteristics of Consumers (Washington, D.C.: Board of Governors of the Federal Reserve System, August 1966).

38/ Kaufman and Detz, "Banking in Chicago," found no significant relation between number of commercial banks and percentages of the population nonwhite or East European. However, a negative relation between number of savings and loan associations and percentage nonwhite, and a positive relation between savings and loan associations and percentage East European were found.

Since individuals frequently use banks convenient to workplace,[39/] employment in the subarea where a bank is located and adjacent areas should be positively related to demand for the bank's services. Employment in various types of industries may have differential effects on bank demand.[40/] Demands by employees in a manufacturing plant are expected to be lower than in nonmanufacturing employees because of shift work and shorter lunch hours.

To obtain an indication of whether persons prefer banks closer to their home or place of work, the ratio of employment in an area to resident population will also be used. The surveys cited above indicate that households tend to choose banks closer to their homes than to their work places, therefore this ratio should be inversely related to demand.

When two or more banks are located in an area, competition is expected to be more vigorous and advertising more extensive. The increased information flow to the public and any resulting improvement in the quality of services may increase the demand for each bank's services. In addition, the location of banks in adjacent areas may have a negative effect on demand for services of an area's

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39/ See page 9 above.

40/ Tulpule, "Distribution of Service Employment," found differential effects on demand arising from manufacturing and nonmanufacturing employment.

banks. Residents in the adjacent areas will likely use fewer services of banks in the area, since other banks are more convenient alternatives.

Households may have a preference for services of larger banks in the CBD because they can obtain more specialized services at these banks in addition to those more widely available. This preference may be reinforced by the extensive advertising campaigns conducted by these banks. However, as persons live and work further from the CBD the cost of travel to banks in the CBD will increase enough to offset any perceived quality differences. Thus, mileage from the CBD should be directly related to demands for local bank services.

Finally, the growth of a subarea and adjacent subareas may affect demand for bank services. In a growing area, households and businesses will require loans to purchase homes and establish or expand businesses. Thus, banks in these areas should experience greater demands for credit services.

The aggregate household demand for service k at banks in area n may then be given by:

$$(2.7) \quad HB_n^k = HB_n^k(\ldots,I_n^k,\ldots;\ldots,C_n^k,\ldots;P,POP,PPOP,MFY,AGE,NWHT,$$
$$MFG,NONMFG,PEMP,EMP/POP,MILP,COMP,$$
$$PCOMP,GR,PGR)$$

where I_n^k, C_n^k, and P are as defined above

HB_n^k = sum of household demands for k at banks in area n

POP = population in an area

PPOP = population in adjacent areas

MFY = median family income

AGE = age of the population

NWHT = percentage of the population nonwhite

MFG = manufacturing employment

NONMFG = nonmanufacturing employment

PEMP = employment in adjacent areas

EMP/POP = ratio of employment to population

MILP = miles to central business district

COMP = number of banks in the area

PCOMP = number of banks in adjacent areas

GR = rate of growth of the area

PGR = growth of adjacent areas

Business Demands for Bank Services

While economic literature has a well-founded theory of the firm, the associated monetary costs of transactions arising from receipts, payments to factors, and capital funds requirements are usually ignored. Since these costs are assumed to be small relative to total cost outlays, little information is lost at the gain of simplicity. For our purposes, however, demands for services of commercial banks are of prime importance. Development of a complete model of a firm's demand for bank services is well beyond the scope of this paper. Instead, we will adopt a more simplistic approach, suggested by the work of Thomas Saving in a recent paper.[41/]

Saving developed a model which treats "the firm as a profit maximizer and derive[s] the demand for money from a general transactions cost function. This approach has the advantage that it allows one to derive the effect of changes in the transactions cost function or other parameters facing the firm not only on the demand for money, but on output decisions as well."[42/] Following his approach, we assume that the firm can define a cost function for bank services which is an envelope of minimum cost combinations of bank services for each level of output. This envelope curve is analogous to the long run cost curve generally defined for the firm.

Let this transactions cost curve be given by:

$$(2.8)\quad m_n^k = m_n^k(p,x;v_1,\ldots,v_R;w_1,\ldots,w_R) \qquad \begin{matrix} k=1,\ldots,K \\ n=1,\ldots,N \end{matrix}$$

41/ Thomas R. Saving, "Transactions Costs and the Firm's Demand for Money," forthcoming in The Journal of Money, Credit, and Banking (August 1972). This section outlines a model of a firm's demand for bank services without explicitly developing all relationships as Saving did in his paper.

42/ *Ibid.*, p. 2.

where m_n^k = amount of service k the firm purchases from banks in subarea n

p = price of firm's output

x = amount of output produced by the firm

v_r = amount of input r used by the firm, r=1,...,R

w_r = price of input v_r, r=1,...,R

We will require (2.8) to be an increasing function:

$$\frac{\partial m_n^k}{\partial x} > 0; \ \frac{\partial m_n^k}{\partial v_r} > 0; \ \frac{\partial m_n^k}{\partial p} \gtrless 0; \ \frac{\partial m_n^k}{\partial w_r} \gtrless 0.$$

Thus, a firm that produces a greater amount of output and uses more inputs will require more bank services. This would arise from higher credit requirements, receipts from customers, payments made for labor and other factors, etc.

The firm maximizes profits, π_i, subject to its production function, $x = F(v_1,\ldots,v_R)$.

$$\text{(2.9)} \quad \pi_i = px - \sum_{r=1}^{R} w_r v_r - \sum_{n=1}^{N} \sum_{k=1}^{K} (I_n^k m_n^k + C_n^k) + \lambda F(v_i,\ldots,v_R;x)$$

where: λ = Lagrangean multiplier

I_n^k = price of service k at banks in area n

C_n^k = monetary costs of travel to purchase m_n^k

and $C_n^k = C_n^k(m_n^k)$; $C_n^k(0) = 0$; $\dfrac{\partial C_n^k}{\partial m_n^k} \gtrless 0.$

The first order conditions for a maximum are:

$$(2.10a)\quad \frac{\partial \pi_i}{\partial x} = p - \Sigma\Sigma \frac{\partial m_n^k}{\partial x} (I_n^k + \frac{\partial C_n^k}{\partial m_n^k}) + \lambda \frac{\partial F}{\partial x} = 0$$

$$(2.10b)\quad \frac{\partial \pi_i}{\partial v_r} = -w_r - \Sigma\Sigma \frac{\partial m_n^k}{\partial v_r} (I_n^k + \frac{\partial C_n^k}{\partial m_n^k}) + \lambda \frac{\partial F}{\partial v_r} = 0; \qquad r=1,\ldots,R$$

R=number of inputs

$$(2.10c)\quad \frac{\partial \pi_i}{\partial \lambda} = F(v_1,\ldots,v_R;x) = 0$$

These yield the following conditions[43/]:

$$(2.11)\quad \frac{p - \Sigma\Sigma m_x (I+C_m)}{F_x} = \ldots = \frac{-w_r - \Sigma\Sigma m_{v_r} (I+C_m)}{F_{v_r}} \ldots = -\lambda < 0$$

This is the familiar condition that marginal revenue must equal marginal costs, and the Lagrangean multiplier, λ, represents this marginal value, a positive quantity. Marginal physical product, F_{v_r}, is positive. In the implicit form of the production function used here, when input levels are held constant marginal output is negative, $F_x<0$. Prices of bank services and transport and communication costs associated with production have the same effect on input/output decisions as price changes in factors and products.

43/ Superscripts and subscripts will be dropped and the simplified notation for partial derivatives will again be used where convenient: $\frac{\partial X}{\partial Y} = X_Y$; $\frac{\partial^2 X}{\partial Y^2} = X_Y^2$.

As for the household, businesses must travel to obtain many bank services and the costs of travel will limit the distance over which firms will travel. However, since many firms use large amounts of bank services, the travel costs will be small relative to the marginal return from use of the service. Thus, larger firms can be expected to use services of banks in a wide geographic area. This can be seen more clearly in the MR = MC conditions (2.11) The terms $\Sigma\Sigma m_x(I+C_m)$ and $\Sigma\Sigma m_{v_r}(I+C_m)$ represent the marginal financial costs of producing an extra unit of ouput x and utilizing an additional unit of input v_r, respectively. They effectively reduce marginal revenue and add to marginal costs. Increased transportation or bank service charges associated with the output will, *ceteris paribus*, cause either a rise in p or a smaller level of output, x, if diminishing returns are present, since MR must equal MC. Likewise, an increase in I_n^k or C_n^k associated with the use of the input, v_r, will cause less of the input to be used or a lower price offered for the input.

The firm's demand for bank services may be stated as:

$$(2.12) \quad fB_n^k = fB_n^k(x,p;v_1,\ldots,v_R;w_1,\ldots,w_R;\ldots,I_n^k,\ldots,C_n^k,\ldots)$$

$k=1,\ldots,K;K=$number of bank services
$n=1,\ldots,N;N=$number of subareas

The signs of the partial derivatives are hypothesized to be:

$$(2.13)\quad \frac{\partial fB_n^k}{\partial x} > 0;\ \frac{\partial fB_n^k}{\partial v_r} > 0;$$

$$\frac{\partial fB_n^k}{\partial p} > 0;\ \frac{\partial fB_n^k}{\partial w_r} < 0;$$

$$\frac{\partial fB_n^k}{\partial I_n^k} < 0;\ \frac{\partial fB_n^k}{\partial C_n^k} < 0;$$

$$\frac{\partial fB_n^k}{\partial I_j^k} > 0;\ \frac{\partial fB_n^k}{\partial I_n^\ell} \gtrless 0;\ \frac{\partial B_n^k}{\partial C_j^k} > 0;\ \frac{\partial fB_n^k}{\partial C_n^\ell} \gtrless 0.$$

Greater production, use of inputs, or product price increases demand for service B_n^k; and increased factor prices decrease demand through decreased use of that factor. Increased price of a bank service and communication costs associated with obtaining the service will decrease demand at that bank, increase demand for the service at other banks, and will effect demands for other services depending upon substitutability between the services.

Following the same procedures used for households, the total demand for services of banks in an area can be obtained by aggregating (2.12) over all firms. Again, competition may cause differences in advertising and quality of services among banks.

The number of banks in the subarea, COMP, and adjacent subareas, PCOMP, will be used as a proxy measure of competition, COMP will be expected to have a positive effect on demands, and PCOMP a negative effect, because of the convenience factor.

Another variable which will affect choice of bank is the size of the bank. Smaller banks do not offer specialized business services or make large loans. Relatively high economies of scale exist for some services, such as international banking, data processing, and trust management. If total demands for these services are below the threshold levels required to make them profitable, banks will refer potential customers to larger banks. Also, to minimize risk in their loan portfolios, banks try to diversify their loans. Thus, smaller banks effectively limit the amount loaned to any one customer. For these reasons, corporations requiring large amounts of credit will generally shop among larger banks to obtain financial services. A dummy variable will be included in the demand equation to capture this size effect.

Thus, the aggregate demand for bank services by business firms may be stated:

$$(2.14) \quad FB_n^k = FB_n^k(\ldots,I_n^k,\ldots;\ldots,C_n^k,\ldots;\ldots,p_q,\ldots;\ldots,x_q,\ldots;\ldots, w_r,\ldots;\ldots,v_r,\ldots;COMP;PCOMP;MMKT)$$

where: $k=1,\ldots,K;K$ = number of bank services
$n=1,\ldots,N;N$ = number of subareas
$q=1,\ldots,Q;Q$ = number of nonbank products
$r=1,\ldots,R;R$ = number of nonbank inputs

I_n^k, C_n^k, w_r, v_r are as defined above

p_q = price of good q

x_q = amount of good q produced

COMP = number of banks in the subarea
PCOMP = number of banks in adjacent areas
MMKT = 1 if bank in area n has assets $\geq$ \$100 million
= 0 otherwise

Finally, the total demand by households and firms can be obtained by adding (2.7) and (2.14). Since the customers' aggregate price vector represents the prices of firms' inputs and outputs, the p_q and w_r are included in P.

$$(2.15)\quad B_n^k = HB_n^k + FB_n^k$$

$$= B_n^k(\ldots,I_n^k,\ldots;\ldots,C_n^k,\ldots;P,POP,PPOP,MFY,AGE,NWHT,MFG,$$

$$NONMFG,PEMP,EMP/POP,MILP,GR,PGR,COMP,PCOMP,\ldots,$$

$$x_q,\ldots;\ldots,v_r,\ldots;MMKT)$$

$k=1,\ldots,K;K$ = number of banking services
$n=1,\ldots,N;N$ = number of subareas

Supply of Bank Services

Commercial banks provide a wide variety of financial services which may be produced in varying proportions. The inputs used by banks can be generally classified as: labor, L, including management; capital, K, including equipment and physical plant; materials, M, including office supplies; and, for loans and investments, deposits. Assuming continuous first and second order partial derivatives, the production function for the bank in implicit form is:

$$(2.16) \quad f(Q^1,\ldots,Q^K;L,K,M) = 0.$$

Q^k is the amount of service k offered by the bank, and inputs appear with negative values and outputs with positive values. This formulation permits all output combinations and allows a good to appear as both an output in some production combinations and an input in others.

Remembering that inputs appear with negative values, we will require the usual condition of diminishing marginal product:

$$(2.17) \quad \frac{\partial f}{\partial L} > 0;\ \frac{\partial^2 f}{\partial L^2} < 0;\ \frac{\partial f}{\partial K} > 0;\ \frac{\partial^2 f}{\partial K^2} < 0;\ \frac{\partial f}{\partial M} > 0;\ \frac{\partial^2 f}{\partial M^2} < 0$$

$$\frac{\partial f}{\partial Q_n^j} > 0;\ \frac{\partial^2 f}{\partial Q_n^{j2}} < 0 \qquad \text{where } Q_n^j \text{ is an input}$$

$$\frac{\partial f}{\partial Q_n^\ell} > 0;\ \frac{\partial^2 f}{\partial Q_n^{\ell 2}} < 0 \qquad \text{where } Q_n^\ell \text{ is an output}$$

We will assume that the bank operates in a competitive factor input market where it takes the prices of labor, w, capital, r, and materials, m, as given and constant for all levels of usage. The prices of bank services will be assumed to be variable within legal limits and determined by the bank. Because of location, quality of service, and market share a bank may be able to exert some degree of monopoly power and set higher interest rates and charges than other banks in the same SMSA.

The cost identity for the bank is:

(2.18) $TC_n = \sum_{j=1}^{J} I_n^j Q_n^j + wL + rK + mM$; where Q_n^j is an input service

Profit maximization by the bank is described as:[44/]

(2.19) $$_n = \sum_{k=1}^{K} I_n^k Q_n^k - (wL+rK+mM) - \lambda f(\ldots,Q_n^k,\ldots,L,K,M)$$

where: π_n = profits of bank n

Q_n^k = amount of service k at bank n; and Q_n^k appears with a negative sign if it is an input service

I_n^k = price of service k at bank n; $I_n^k = I_n^k\ (Q_n^k)$;

and $I_n^k \leq I_n^{k*}$ where I_n^{k*} is the legal maximum rate.

44/ Reserve requirements and specifications on capital requirements operate as constraints on loan and investment operations, but these will be ignored in this analysis, since our ultimate aim is to estimate the levels of demand facing a bank and not the exact nature of its production decisions.

The first order necessary conditions for (2.19) to be a maximum are:

$$(2.20a)\quad \frac{\partial \pi_n}{\partial Q_n^k} = \frac{\partial I_n^k}{\partial Q_n^k} - \lambda \frac{\partial f}{\partial Q_n^k} = 0 \qquad k=1,\ldots,K$$

$$(2.20b)\quad \frac{\partial \pi_n}{\partial L} = - w - \lambda \frac{\partial f}{\partial L} = 0$$

$$(2.20c)\quad \frac{\partial \pi_n}{\partial K} = - r - \lambda \frac{\partial f}{\partial K} = 0$$

$$(2.20d)\quad \frac{\partial \pi_n}{\partial M} = - m - \lambda \frac{\partial f}{\partial M} = 0$$

$$(2.20e)\quad \frac{\partial \pi_n}{\partial \lambda} = f(\ldots,Q_n^k,\ldots;L,K,M) = 0$$

Dropping the superscripts and subscripts as before, this implies that marginal revenues must equal marginal costs for each pair of inputs and outputs:

$$(2.21)\quad \frac{I_Q}{f_Q} = - \frac{w}{f_L} = - \frac{r}{f_K} = - \frac{m}{f_M} = \lambda<0$$

Although the bank's production function has not been explicitly defined, the general form of its marginal cost curves can be derived from the above and expressed as:45/

45/ Since data limited estimation of the model to demand equations only, see Chapter III, we have not developed a complete model of a commercial bank's production decisions. Instead, the traditional formulations derived for a firm's marginal cost, factor demand, and

$$(2.22) \quad MC_n^k = g_n^k(Q_n^k;\ldots,I_n^j,\ldots,w,r,m,\alpha,\beta,\delta,\gamma^1,\ldots,\gamma^J)$$

$$k=1,\ldots,K$$
$$n=1,\ldots,N$$

where $\alpha,\beta,\delta,\gamma^j$ are parameters of the production function relating to the returns to the respective factor and its elasticity of substitution, and:

$$(2.23) \quad \frac{\partial MC_n^k}{\partial I_n^j} > 0; \quad \frac{\partial MC_n^k}{\partial w} > 0; \quad \frac{\partial MC_n^k}{\partial r} > 0 \quad \frac{\partial MC_n^k}{\partial m} > 0$$

$$\frac{\partial MC_n^k}{\partial Q_n^k} \gtrless 0 \quad \text{depending upon the parameters of the production function.}$$

The bank's demand curves for inputs, L, K, M, and Q^j, will have the form:

$$(2.24) \quad L = \sum_{k=1}^{K} g_k(Q^k;w,r,m,I^1,\ldots,I^J,\alpha,\beta,\delta,\gamma^1,\ldots\gamma^J)$$

$$K = \sum_{k=1}^{K} h_k(Q^k;w,r,m,I^1,\ldots,I^J,\alpha,\beta,\delta,\gamma^1,\ldots,\gamma^J)$$

$$M = \sum_{k=1}^{K} \ell_k(Q^k;w,r,m,I^1,\ldots,I^J,\alpha,\beta,\delta,\gamma^1,\ldots,\gamma^J)$$

45/ (Continued)
marginal revenue curves have been adopted. The analysis presented here follows that in R.G.D. Allen, Mathematical Economics (2nd Ed. New York: St. Martin's Press, 1966), pp. 613-617.

$$Q^{j} = \sum_{k=1}^{K} q_k(Q^k, w, r, m, I^1, \ldots, I^J, \alpha, \beta, \delta, \gamma^1, \ldots, \gamma^J)$$

If banks operated in perfectly competitive markets, their marginal cost curves would be supply curves and the market price would determine their levels of output. Commercial banks within a metropolitan area are not perfect competitors, however. In one of the first major articles concerning competition in banking, Lester Chandler argues that the theory of monopolistic competition should be used when studying bank markets.[46/] The assumptions of pure competition are violated most strongly in the following ways:

(a) Although the practice has declined recently, prices of bank services are generally set near levels established by agreements among clearing house members and correspondent banks.

(b) Prices are restricted to lie below levels set by regulatory agencies and these limits may prevent prices from reaching market clearing levels.

(c) Quality and location differences create non-homogeneous products.

(d) The number of sellers in any market is small enough so that an individual bank can influence the market to some degree.

(e) Entry into the market is restricted by bank regulatory agencies and branching laws.

46/ Lester V. Chandler, "Monopolistic Elements in Commercial Banking," Journal of Political Economy, Vol. XLVI, No. 1 (February, 1938), pp. 1-22.

(f) Customers rarely "shop" widely among banks for the best services and prices, but choose among the most convenient banks; this is especially true of individuals and smaller business firms.

Price competition among banks is not strong. Although some price variation is evident, banks tend to use non-price competition.

> "...Price competition is employed by commercial banks mainly in areas where banks have nonbank rivals..."47/

> "...Official spokesmen have publicly declared 'that the competition between banks is in quality of service; that there is seldom a question of price...'"48/

One reason price competition is so limited is the existence of ceiling rates, such as those established under the Federal Reserve's Regulation Q, state usury laws, and FHA-VA ortgage regulations. If these ceilings prevent the establishment of market clearing rates, both customers and banks are prevented from reaching the optimum quantities that would be achieved in a competitive market. Therefore,

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47/ Jack M. Guttentag and Edward S. Herman, "Banking Structure and Performance," The Bulletin, New York University Graduate School of Business Administration, Institute of Finance, No. 41/43 (February, 1967), p. 16.

48/ David A. Alhadeff, "The Market Structure of Commercial Banking in the United States," Quarterly Journal of Economics, Vol. LXV, No. 1 (February, 1951), p. 65.

bankers primarily use nonprice competition to attract customers. Advertising, quality improvements, and locational advantages cause customers to view bank services as non-homogeneous products, thereby minimizing the effectiveness of price competition.

Even in large cities where there are many banking alternatives, the number of sellers is never large enough that the behavior of one bank has no effect on competitors. Small banks as well as the major banks can influence the behavior of competitors, as indicated by a survey of New England banks, conducted by Steven Weiss:

> "The New England survey revealed 55 banks that were clearly first in their service area to offer or announce 'free' checking plans. Of this number, roughly two-thirds (37) are either new banks or relatively small institutions, in either case banks on the competitive fringe of their respective market areas."49/

Entry into banking is restricted by several regulatory agencies. Depending upon the class of bank, at least one of these agencies must approve the chartering of a new bank or the establishment of additional branches: Comptroller of the Currency, Federal Deposit Insurance Corporation, Federal Reserve Board, and state banking authority. Although capital requirements are modest, a significant number of applications are denied each year as the regulators

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49/ Steven J. Weiss, "Commercial Bank Price Competition: The Case of 'Free' Checking Accounts," Federal Reserve Bank of Boston, New England Economic Review (September/October, 1969), p. 10.

try to promote competition through the prevention of an "overbanked" situation. An example of the significant barrier to entry presented by these agencies is shown by the large proportion of applications denied each year by the Comptroller (see Table 4). Between 1965 and 1968, 67 percent of the 322 charter applications and 21 percent of the de novo branch applications were denied by the Comptroller.

Finally, customers generally do not have perfect knowledge of the prices and quality of services provided by the various banks in their area. Once a bank has been chosen, customers do not "shop" among banks to compare the services they are getting with those offered by other banks. Surveys show that customers generally do not change banks unless they become dissatisfied with the service they are receiving.[50/]

Acknowledging the existence of imperfect competition in banking and the importance of advertising and quality differences among banks implies that the profit maximization equation (2.19) and marginal cost equation (2.22) would be more correctly specified if a quality index and advertising expenditures were included. The difficulties in constructing the former and allocating the latter among a bank's outputs led to the adoption of two dummy variables to measure competition.

50/ See Kaufman, Elkhart, p. 34.

TABLE 4

APPLICATIONS FOR NATIONAL BANK CHARTERS*
AND DE NOVO BRANCHES

	1965	1966	1967	1968
Charter				
Applications Processed	162	70	50	40
Approved	27	28	9	16
(Percent of processed)	(16.7)	(40.0)	(18.0)	(40.0)
Rejected	119	38	39	21
(Percent of processed)	(73.5)	(54.3)	(78.0)	(52.5)
Abandoned	16	4	2	3
(Percent of processed)	(9.9)	(5.7)	(4.0)	(7.5)
De Novo Branch				
Applications Processed	853	809	753	905
Approved	657	626	438	628
(Percent of processed)	(77.0)	(77.4)	(58.2)	(69.4)
Rejected	157	140	254	171
(Percent of processed)	(18.4)	(17.3)	(33.7)	(18.9)
Abandoned	39	43	61	106
(Percent of processed)	(4.6)	(5.3)	(8.1)	(11.7)

* Excludes conversions

Source: Comptroller of the Currency, Annual Report, 1965, 1966, 1967, 1968.

First, as in the demand equation, the number of banks in the subarea and adjacent areas will be used as an indication of competition and the resulting advertising and quality differences. Second, since loan ceilings prevent small banks from meeting credit requirements of large firms, they are not able to compete strongly for these loans. To indicate this, the dummy variable MMKT added to business demand equation (2.14) will be included.

Also, it will be assumed that banks react to disequilibrium in markets with a lag, because bank markets are imperfectly competitive. When a bank adjusts price, quality, or advertising, the reaction of competitors must be considered. Thus, banks will react to disequilibrium with a lag so that the previous period's price, $I^k_{n,t-1}$, and demand, $B^k_{n,t-1}$, will also appear in the banks' production decisions.[51/]

Adding these three variables, the revised marginal cost function will be of the form:

$$(2.25)\quad MC^k_n = g^k_n(Q^k_n;\ldots,I^j_n,\ldots,w,r,m,\alpha,\beta,\delta,\gamma^1,\ldots,\gamma^J,COMP,PCOMP,MMKT,$$
$$B^1_{n,t-1},\ldots,B^K_{n,t-1};I^1_{n,t-1},\ldots,I^K_{n,t-1})$$
$$k=1,\ldots,K$$
$$n=1,\ldots,N$$

51/ The length of the lag will not be specified since we are concerned with a static test of the model. However, it would be expected that bankers adjust prices daily in some markets, such as Fed funds, almost weekly in the case of prime loan rates, and very infrequently for such services as savings accounts.

Although a supply curve in the sense of perfect competition cannot be defined for firms in imperfectly competitive markets, the optimum levels of output and price can be obtained. The bank will equate marginal cost (2.25) with marginal revenue, MR_n^k:

$$(2.26) \quad MR_n^k = I_n^k + B_n^k \frac{dI_n^k}{dB_n^k} \qquad \begin{array}{l} k=1,\ldots,K \\ n=1,\ldots,N \end{array}$$

$$(2.27) \quad MR_n^k = MC_n^k \qquad \begin{array}{l} k=1,\ldots,K \\ n=1,\ldots,N \end{array}$$

Since prices of bank services may not exceed legal maximums, when these limits become effective in preventing equilibrium (2.27) the bank can adjust quality and advertising to increase the supply of deposits forthcoming at the ceiling rate, but not necessarily enough to clear the market. Thus the usual market clearing conditions will be replaced by a set of equations. If the equating of MR_n^k and MC_n^k can be done below price ceilings, markets are cleared at each bank. Otherwise, markets are not cleared and banks or customers arrive at a second-best situation.

Defining $\hat{I}_n^k$ = market clearing price determined by (2.27)

I^{k*} = legal maximum rate

$\hat{B}_n^K$ and B_n^{k*} = demand for k at banks in n at the market clearing and legal maximum rates, respectively.

$\hat{Q}_n^k$ and Q_n^{k*} = supply of k by banks in n at market clearing and legal maximum rates, respectively.

(2.28a) If $\hat{I}_n^k \leq I^{k*}$, then $\hat{I}_n^k$ is the prevailing market rate and $\hat{B}_n^k = \hat{Q}_n^k$.

(2.28b) If $\hat{I}_n^k > I^{k*}$, then I^{k*} prevails and the amount of loan, savings, and demand deposit services, etc. sold, Q_n^{k*}, will be less than the equilibrium quantity:

$Q_n^{k*} < \hat{Q}_n^k < B_n^{k*}$;

For services for which the customer receives interest, the amount held by customers, B_n^{k*}, will be less than equilibrium quantity:

$B_n^{k*} < \hat{Q}_n^k < Q_n^{k*}$

We will denote the actual levels of bank services prevailing at anytime as BS_n^k.

Summary

The model of commercial banking within a metropolitan area is summarized in Table 5. The approach taken in the development of the model was to employ the well-known theories of consumer and business firm decision making based on standard optimizing techniques, without explicitly defining the underlying functions.

TABLE 5

SUMMARY OF MODEL OF COMMERCIAL BANKING WITHIN A METROPOLITAN AREA

	Structural Equations		Endogenous Variables		Exogenous Variables
K	Travel to Bank (2.1)	K	Prices of Bank Services, I_n^k		Price of All Goods, P
K	Travel Costs to Bank (2.2)	K	Travel Costs to Bank, C_n^k		Amount of Nonbank Services Demanded, X
K	Demands for Bank Services (2.15)	K	Travel to Bank, T_n^k		Population, POP
K	Marginal Costs (2.25)	K	Demands for Bank Services, B_n^k		Population in Adjacent Areas, PPOP
3	Demand for Bank Factor Inputs, L, M, K (2.24)	K	Marginal Costs of Bank Outputs, MC_n^k		Median Family Income, MFY
K	Marginal Revenue (2.26)	K	Marginal Revenue of Bank, MR_n^k		Age of the Population, AGE
K	MR = MC Constraints (2.27)	K	Actual Levels of Bank Services, BS_n^k		Percentage of the Population, Nonwhite, NWHT
K	Market Conditions (2.28)	3	Factor Demands by Banks for L, K, M		Manufacturing Employment, MFG
					Nonmanufacturing Employment, NONMFG
					Employment in Adjacent Areas, PEMP
					Ratio of Employment to Population, EMP/POP
					Miles to CBD, MILP
					Number of Banks in Area, COMP
					Number of Banks in Adjacent Areas, PCOMP
					Rate of Growth, GR
					Rate of Growth of Adjacent Areas, PGR
					Size of Banks, MMKT
				Q	Levels of Outputs of Firms, x_q
				R	Levels of Inputs of Firms, v_r
				3+J	Parameters of Banks' Production Function, α, β, δ, $\gamma^1, \ldots, \gamma^J$
				3	Prices of Factor Inputs of Banks, w, r, m
				K	Lagged Demands for Bank Services, $B^k_{n,t-1}$
				K	Lagged Prices of Bank Services, $I^k_{n,t+1}$
				K	Legal Price Ceilings, I^{k*}
	(7K + 3) Equations		(7K + 3) Variables		(3K + J + Q + R + 23) Variables

K = number of bank services
J = those services supplying loanable funds to bank
N = number of subareas in SMSA

Households' demands for bank services were hypothesized to be determined by prices of goods and bank services, location of banks, advertising and quality of bank services, population, income, age, place of employment, ethnic background, and neighborhood growth. Businesses' demands were hypothesized to be dependent on prices of bank services, bank location, prices of factors and products, output and input levels, size of the bank, and quality of bank services.

The bank was assumed to be a profit maximizer within the limits of legal operating constraints and to be able to set prices, quality, and advertising levels within these limits. The markets for bank services did not necessarily clear because of interest rate ceilings and time lags occurring as banks fully adjusted to new demand levels.

CHAPTER III

EMPIRICAL PROCEDURES

The model developed in Chapter II was composed of three general types of equations: households' and businesses' demands for bank services, banks' supply of services, and market behavioral conditions. The estimation of the entire system of equations was not possible because some data were not available, primarily for those variables determining the supply of bank services - wage rates, number of employees, amounts of material and capital inputs used, and production function parameters. Thus, only the demand equations were estimated.

In the next two sections of this chapter, the equations estimated and the reasons for testing the model in the Chicago SMSA are given. Then, the nature of the data used and the measurement of bank output are described.

Demand Equations Estimated

The demand equations (2.15) estimated were chosen to represent bank services utilized by both households and business firms.[52/]

52/ By the necessary order condition for identification of a single equation in a simultaneous equation model, the demand equations are over-identified: the number of predetermined variables excluded from any demand equation, J + 3K + 6, exceeds the number of included en-

The three types of credit services selected were: commercial and industrial loans, real estate loans, and loans to individuals.[53/] The first are demanded by business firms, the second by both households and businesses, and the third by individuals. Demands were also estimated for savings deposits, which are primarily held by individuals, and for total demand deposits of individuals, partnerships, and corporations (IPC). Finally, total assets were used to capture the total demand for all bank services. While total assets do not measure the wide variations in the relative demands for various types of loans or deposits, they do indicate to some degree the total of these demands.

The subareas of observation proposed for this study are defined as "neighborhoods" of the central city of the SMSA and its suburbs. While a grid system would provide metropolitan area observation areas with similar size and shape, an area with a central focus

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52/ (Continued)
dogenous variables less one, 2K. (See Carl F. Christ, Econometric Models and Methods (New York: John Wiley & Sons, Inc., 1966) p. 327.) While two stage least squares or a full information method of estimation would be preferred to the ordinary least squares procedure adopted, the former methods of estimation were not feasible since they require data on all the exogenous (predetermined) variables in the model and these data were not available.

53/ Bank services were chosen from those items included in the semiannual Reports of Condition which banks must make to the appropriate regulatory agency.

of activity more closely represents the market area of a bank. Banks tend to locate in neighborhood retail and commercial centers. Households and businesses in the area go to these centers for services of various firms, including banks. Also, businesses and households should be more homogeneous within neighborhood areas than in areas derived from a grid system. In the latter, area boundaries are drawn irrespective of trading patterns, highway systems, residential developments, etc.

The demand equations were hypothesized to have the general functional form of demographic potential models, which have been applied in the estimation of retail sales, migration, etc. Demographic potential at a point may be simply defined as the influence exerted on that point by masses located at various distances around that point.54/ The distance effect may enter the potential equation in several ways. Three forms were chosen for estimation in this study. They were:

54/ The concept of demographic potential was first stated in its present form by J. Q. Stewart. See for example his "Demographic Gravitation: Evidence and Applications," Sociometry, Vol. XI (February and May, 1948), pp. 31-58; and "Empirical and Mathematical Rules Concerning the Distribution and Equilibrium of Population," Geographical Review, Vol. XXVII (July, 1947), pp. 461-485. For a discussion of the gravity concept see Walter Isard, Methods of Regional Analysis: An Introduction to Regional Science (Cambridge, Mass.: The M.I.T. Press, 1960), Chapter 11.

$$V_i = G \sum_j \frac{M_j}{d_{ij}} \qquad j=1,\ldots,J;J = \text{number of distant points}$$

$$V_i = G \sum_j \frac{M_j}{d_{ij}^2}$$

$$V_i = G \sum_j M_j^{-d_{ij}}$$

where: V_i = total potential exerted on point i

G = the potential constant

M_j = mass at point j

d_{ij} = distance between points i and j

As hypothesized in Chapter II, distance should have an inverse relation with demand. Since the costs, disutility, and time associated with travel increase with distance traveled, the further households and businesses are from a bank, the smaller the amount of the bank's services demanded. Therefore, the importance of convenience to bank customers and the number of banks located throughout a metropolitan area limit the geographic area from which a bank primarily derives its customers. For this study, the geographic area was hypothesized to be the subarea where the bank was located and adjacent subareas.

In all three potential forms, population and business characteristics of the subarea entered the equation separately from their sum over adjacent subareas weighted by distance. For example, supposing that population, POP, and employment, EMP, were the only two independent variables in a demand equation, the equation estimated would be stated as:

$$B_n^k = b_0 + b_1 POP_n + b_2 \sum_{j=1}^{J} \frac{POP_j}{d_{nj}} + b_3 EMP_n + b_4 \sum_{j=1}^{J} \frac{EMP_j}{d_{nj}}$$

where b_0, b_1, b_2, b_3, b_4 are parameters to be estimated

d_{nj} = mileage from the geographic center of subarea n to the center of subarea j

J = number of adjacent subareas

By separating POP_n from $\sum_j POP_j / d_{nj}$ the differential effects of adjacent and within area demand become clearer and it also removes the problem of d_{nj} going to zero when j=n.

Choice of the Chicago SMSA for Estimation of Demand Equations

The Chicago Standard Metropolitan Statistical Area (SMSA) was chosen as the metropolitan area for which the demand equations were estimated for the following reasons: the metropolitan area is large enough that many sub-market areas for bank services are likely to be present; Illinois is a unit banking state; and good population and employment data are available for subareas within the SMSA.

Since banking is primarily a convenience industry, within a large metropolitan area it is likely that many over-lapping market areas exist for bank services. With a sufficient number of these market areas, intraurban demands for bank services can be estimated. The Chicago SMSA was large enough that 141 bank market areas could be defined. These subareas included 66 suburbs whose population was at least 10,000 in 1960 and 75 community areas within the City of Chicago.[55/] The number of areas was great enough that demand functions could be estimated separately for the suburbs and Chicago community areas to determine if the same structure equation could be applied to both.

Dollar amounts of various types of deposits and loans were available for all insured commercial banks, but not for individual bank branches. Since demand was to be estimated by bank office, it was necessary to choose an SMSA in a unit banking state. Illinois state law prohibits branch banking, therefore Chicago SMSA bank data reflected demand at bank offices.[56/]

55/ See page 63 below.

56/ Illinois banks may operate one limited service drive-in facility within 1500 yards of the bank.

Finally, the Chicago SMSA was chosen because several good series of population and employment data were available for the suburbs and also community areas within the City of Chicago. These data series were developed to facilitate research by the University of Chicago and the Hospital Planning Council for Metropolitan Chicago.

Description of Independent Variable Data

Demands for the six services were estimated for the Chicago SMSA for the years 1962 and 1968.[57/] Data were available for these years for some variables, while for others estimates were made. In addition, no measure of some variables was available.

The 66 large suburbs in the Chicago SMSA and 75 community areas of the City of Chicago were used as subareas of observation. The community areas correspond to those defined in the Local Community Fact Book - Chicago Metropolitan Area.[58/] These areas were drawn in consideration of ethnic, income, employment, and other characteristics of the area as well as natural and man-made boundaries, such as rivers and interstate highways. While they do not have regular

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57/ At the time this study was begun, these were the earliest and latest years, respectively, for which bank data were available.

58/ Evelyn M. Kitagawa and Karl E. Taeuber, eds., Local Community Fact Book - Chicago Metropolitan Area, 1960 (Chicago: Chicago Community Inventory, University of Chicago, 1963).

shapes or uniform size, they do have centers of activity that tend to make them well defined areas.

Dollar amounts of the six bank services, the number of banks in a subarea, and bank assets, which were used to determine the value of the money market dummy, were obtained directly from Reports of Condition of all insured commercial banks. Population, median family income, percentage of the population between the ages of 18 and 64, and percentage of the population nonwhite were estimated for 1962 and 1968 from 1960 Census data and Hospital Planning Council estimates.[59/]

Manufacturing and nonmanufacturing employment data were available for all suburbs for 1962 and 1968 but only by zip codes for the City of Chicago. Employment data were aggregated over the zip codes most closely corresponding with the Chicago community areas to obtain employment estimates. The sum of manufacturing and nonmanufacturing employment was defined as total employment to obtain observations for the variables PEMP and EMP/POP.

The growth variables, GR and PGR, were hypothesized to reflect expansion of both population and employment. However, since employment series could not be obtained for a sufficiently long period, only population growth data were used. The notation for the growth variables in the demand estimates were POPGR and PPOPGR.

59/ See Appendix A for complete description of data sources.

Transportation costs could not be easily measured, because they depend on mode, time, and distance. The simplest proxy cost measure, and the one used here, was mileage between geographic centers of subareas. Studies of transportation costs indicate that total costs are directly proportional to distance, thus distance should provide a good indication of costs. This distance was used to calculate population, employment, and competition potentials. The distance, in miles, from the CBD to the geographic center of each subarea was used for MILP.

No data were available for the price index of the composite good, P. Prices may vary throughout the SMSA, i.e., rent and wage gradients may exist. The greatest price variation should be observed for those products, such as retail and service goods, which the consumer purchases frequently and therefore shops for over a limited geographic area. Merchants selling such products have a wider range of prices which they can charge, since small price differences will not offset the travel costs which customers would incur if they traveled further for the service. However, for more expensive items, such as cars and furniture, prices should be more uniform because the consumer will shop over a wider area to obtain the best price for such a large expenditure. Since these more durable goods are the items which should have the greatest relative effect on demands for loans and deposits, omission of the price variable should have only a minor effect on estimates of dollar demand for bank services.

No output or factor input measures were available for businesses within the SMSA. It was hypothesized that the level and type of production of a firm have an important effect on demands for bank services. The only data available to indicate these factors were the number of manufacturing and nonmanufacturing employees in the subarea. Since employment does not have a constant relation to production levels, the empirical results obtained from these proxy variables should be viewed with caution.

Finally, no reliable bank price data were available. Several problems precluded the use of a proxy indicator of price. First, advertised and effective interest rates on both deposits and loans often differ because of variation among banks with respect to compounding. Secondly, prices of one service are often tied to the amount of another service used. The best known example of this is compensating balances, i.e., specified minimum deposits which a customer must maintain to obtain credit at the specified lending rate. Thirdly, quality of service varies among banks, so that any observed price difference may merely reflect quality variation. Finally, price measures based on income or expenses, such as the ratio of total interest paid to total deposits, do not indicate the varying risk and term composition of the bank's portfolio, which have very important effects on interest rates and service charges.

The evidence of bank price variation or constancy within metropolitan areas is very sparse, even though most studies of bank performance use counties or SMSAs as the relevant market area and thereby implicitly assume uniform prices within the area. Using the ratio of total interest paid to total time and savings deposits, Franklin R. Edwards calculated the average interest rate variation across SMSAs of various sizes in 1962.[60/] The average variance of interest rates on time and savings deposits, expressed in basis points, ranged from only .04 to .28 for various size groups of SMSAs. His results indicated that, "Although the degree of price disparity varies directly with the size of the city, a significant difference is found between average prices in different sections of the metropolitan area (suburban v. city) only in very large unit banking areas," and the SMSA which showed the largest differences was Chicago.[61/]

60/ Franklin R. Edwards, "The Banking Competition Controversy," The National Banking Review, Vol. III, No. 1 (September, 1965), pp. 1-34.

61/ Ibid., p. 11. Unfortunately, he did not indicate how much variation was present.

A direct relation between size of the SMSA and variation of interest rates paid on time and savings deposits was also found in a study by Paul Horvitz (see Table 6).[62/] Horvitz's data were based on stated interest rates rather than the crude ratio of total interest paid to total deposits, which Edwards used. The standard deviations in Horvitz's study are larger than those calculated by Edwards. This may reflect the fact that interest rates were generally more stable in 1962 than in 1967.

TABLE 6

AVERAGE STANDARD DEVIATIONS OF
MAXIMUM RATES PAID ON SAVINGS DEPOSITS
(in basis points)

	Unit Banking	Limited Branching
Small SMSAs[a/]	22.3	26.9
Large SMSAs	39.2	44.2

a/ Population under 1,000,000 in 1960

Source: Horvitz, "Price Uniformity."

62/ Paul M. Horvitz, "Price Uniformity and Banking Markets," Appalachian Finance Review, (Spring, 1969). Mary Mitchell, in an unpublished paper, "Variations in Commercial Bank Interest Rates on Savings and Time Deposits," (1967), also found interest rate variation within SMSAs. In 15 of 22 cases, she found the variance of interest rates greater for suburban banks than for central city banks.

Schweiger and McGee also found some variation in stated interest rates on loans within SMSAs.[63/] For example, "Charges for a standard automobile loan varied substantially among banks within a city...[64/] For Chicago suburbs, average rates were generally lower the greater the number of banks in the suburb (see Table 7). Interest rates also showed variations among the counties in the SMSA.

TABLE 7

MEAN INTEREST RATES ON AUTOMOBILE LOANS[a/]
CHICAGO SUBURBS, 1960
(Number of Sample Banks in Parentheses)

	Number of Banks in Town			
Location	One	Two	Three or More	All Towns[b/]
Cook Co.	10.9% (22)	10.8% (25)	10.7% (16)	10.8% (60)
Du Page Co.	11.0 (6)	10.7 (6)	*	10.9 (12)
Kane Co.	12.6 (2)	12.6 (4)	11.0 (6)	12.0 (12)
Lake Co.	11.7 (4)	11.0 (4)	10.7 (3)	11.3 (11)
McHenry Co.	10.4 (6)	11.1 (4)	*	10.6 (10)
Will Co.	12.2 (4)	*	11.0 (3)	11.9 (7)

a/ Means are simple unweighted averages of all sample banks in cell
b/ Means are weighted averages of subgroups
* No Cases

Source: Schweiger and McGee, Chicago Banking, p. 59.

63/ Irving Schweiger and John S. McGee, Chicago Banking: The Structure and Performance of Banks and Related Financial Institutions in Chicago and Other Areas (Chicago: University of Chicago Graduate School of Business, 1961).

64/ Ibid., p. 9.

To determine the degree of interest rate variation in the Chicago SMSA for the years included in this study, the author obtained data for Federal Reserve member banks from the Survey of Time and Savings Deposits, December 1962 and December 1968. The earlier date, when interest rates were generally lower, showed lower mean interest rates on savings deposits than in 1968 for each subgroup, and generally a higher standard deviation in rates (see Table 8). Since the ceiling was 4.0 percent in both years, as the mean rate rose closer to the maximum there was less room for variation.

TABLE 8

INTEREST RATES ON SAVINGS DEPOSITS,
FEDERAL RESERVE MEMBER BANKS IN THE CHICAGO SMSA*

Subarea	Mean Rate 1962	Mean Rate 1968	Standard Deviation 1962	Standard Deviation 1968
City of Chicago	3.58%	3.84%	.62	.43
Cook County Suburbs[a/]	3.53	3.90	.65	.27
DuPage, Lake, Kane, and Will County Suburbs[a/]	3.63	3.93	.29	.22
Rural Areas	3.44	3.81	.34	.34
Total Chicago SMSA	3.54	3.86	.54	.35

* Includes 176 of the 259 commercial banks operating in 1962 and 169 of 294 banks in 1968.

a/ Suburbs of over 10,000 population in 1960.

To test whether the mean rates given in Table 8 were significantly different, t tests were used.65/ The only mean rates which were significantly different were those in 1962 for the suburbs outside of Cook County and the rural areas. Thus, while savings deposit rates varied among SMSA banks, the mean rates paid in various areas were not significantly different.

In summary, several studies have indicated that rates charged by banks in large metropolitan areas, such as the Chicago SMSA, do differ. However, it is not clear that these differences are significant in a statistical sense. To the extent that these price variations reflect quality and locational characteristics of the area, the influence of the omitted bank price variables in the estimated demand equations may be reflected by the competition and location variables.

Measurement of Bank Output

One of the most basic problems encountered in all studies of bank markets, costs, and performance is the measurement of bank output. Commercial banking is a service industry. Unlike industries which produce well defined physical products, the unit of

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65/ Since variations differed among subareas the t value for a 5 percent significance level was adjusted using the method developed by William G. Cochran and Gertrude M. Cox, Experimental Designs (New York: John Wiley & Sons, Inc., 1960).

output in a bank has been variously measured by number of loans or accounts, their dollar volumes, or activity per account.

One type of output measure which has been used in bank cost studies is based on the number of transactions per period.[66/] The operating costs that banks incur depend primarily on the number of checks and loan payments processed, the number of deposits and withdrawals, etc. The dollar size of each transaction has little effect on the cost involved. Thus, if two banks have the same dollar amount of demand deposits, the one which processes more checks bears the higher costs.

From a consumer viewpoint, the number of checks is a good indication of output. Each check represents record keeping, safety, and convenience to the consumer. The dollar volume of the check has little relation to utility gained from the service. However, for loans and time deposits, the dollar size of an account may be a more relevant output measure for the consumer. The customer likely views his deposit balance as an asset, whose safety and income are guaranteed by the bank. The number of deposits and withdrawals are only incidental to holding the asset. For loans, the dollar amount repre-

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66/ See Frederick W. Bell and Neil B. Murphy, Costs in Commercial Banking: A Quantitative Analysis of Bank Behavior and Its Relation to Bank Regulation, Federal Reserve Bank of Boston Research Report No. 41 (April, 1968); George J. Benston, "Economies of Scale and Marginal Cost in Banking Operations," The National Banking Review, Vol. II, No. 4 (June, 1965), pp. 507-549.

sents the level of financing the customer is interested in obtaining, rather than the number of repayments. Thus for some activities, number may not be a true measure of the amount of service demanded by customers.

Some studies have used output measures based on a bank's gross revenue.[67/] If people pay interest and service charges corresponding to their evaluation of the worth of the service, then gross income can serve as an output measure. However, gross income is also "a function of the elasticity of demands individual banks face, the riskiness of earning assets, and the production costs of earning assets."[68/]

The earlier studies of bank costs used total dollar amounts of deposits, loans, or assets to measure bank size, which was then the output proxy.[69/] This approach not only obsures variation in

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67/ See Stuart I. Greenbaum, "A Study of Bank Costs," The National Banking Review, Vol. IV, No. 4 (June, 1967), pp. 415-434. John Anthony Powers, "Branch Versus Unit Banking: Bank Output and Cost Economies," Southern Economic Journal, Vol. XXXVI, No. 2 (October, 1969), pp. 153-164.

68/ George J. Benston, "Economies of Scale of Financial Institutions," Working Paper Series, No. 7019A, University of Rochester, College of Business Administration, p. 12.

69/ David A. Alhadeff, Monopoly and Competition in Banking (Berkely: University of California Press, 1954); Lyle E. Gramley, A Study of Scale Economies in Banking, Federal Reserve Bank of Kansas City, (1962); Paul M. Horvitz, "Economies of Scale in Banking," Private Financial Institutions, Commission on Money and Credit Research Studies (Englewood Cliffs: Prentice-Hall, 1963), pp. 1-54.

the proportion of time deposits, demand deposits, loans, and investments held, but also ignores corresponding differences in the risks of assets and costs of producing the different services.

For this study, the only indication of output for which both loan and deposit data could be obtained for all banks was dollar volume. While this measure does have the limitations discussed above, it was possible to obtain data by specific types of loans and deposits to reduce the degree of risk and activity variation present in more aggregate measures of output.

Summary

Six demand functions were selected for estimation: commercial and industrial loans, real estate loans, loans to individuals, savings deposits, IPC demand deposits, and total assets. The Chicago SMSA was chosen as the metropolitan area over which these demand functions were estimated for 1962 and 1968.

Data were obtained for 141 subareas of the SMSA, and the functional forms of the equations were hypothesized to be of the type used in demographic potential models. Data for a given area and those areas adjacent to it determined the observed values of the independent variables.

Data were available or readily estimated for most independent variables. However, four variables lacked quantitative measures. The most important of these were bank prices. The limited interest rate data available, savings deposit interest rates at Federal Reserve member banks, implied that some intra-metropolitan variation in interest rates was probably present in both 1962 and 1968. Thus, due to the absence of price data in the estimated equations, caution should be taken in the interpretation of the empirical results.

Total dollar volumes were used to measure levels of demand. While this was not an ideal indication of the amount of a service a bank provides, it was the only measure for which data could be obtained for all banks.

CHAPTER IV

BANKING ACTIVITY IN THE CHICAGO SMSA—AN EMPIRICAL TEST OF THE MODEL

An Overview of the Geographic Distribution of Economic Activity in the Chicago SMSA

The Chicago SMSA, with a population of nearly 7 million, is the third largest metropolitan area in the United States.[70/] The City of Chicago is located on the southwestern shore of Lake Michigan with the metropolitan area extending around the city in a semi-circle. Cook County, where Chicago is located, has the greatest population and employment of the six counties forming the SMSA, and McHenry County has the least.[71/] The major suburban communities extend from the Chicago City limits and along the major highways radiating from downtown Chicago.

Within the last thirty years, economic activity has become increasingly suburbanized. Between 1940 and 1970, the portion of SMSA population residing in the City of Chicago fell from 74.3 percent to 48.2 percent. The changing geographic distribution of

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70/ U.S. Department of Commerce, Bureau of the Census, 1970 Census of the Population, Number of Inhabitants, United States Summary (December, 1971).

71/ No city in McHenry County had a population exceeding 10,000 in 1960.

economic activity between the years 1962 and 1968, for which the bank model was tested, is described in Table 9. The metropolitan area was divided into four subareas: the Loop, which is the central business district of Chicago; the remainder of the City of Chicago outside of the Loop; suburbs in the SMSA which had a population of at least 10,000 in 1960; and the remaining area.

The Loop is primarily a commercial and entertainment center for the SMSA, with a very small resident population. Employment in the Loop is concentrated in nonmanufacturing industries, and jobs in this sector fell between 1962 and 1968. The jump in population during the period reflects the construction of luxury apartment buildings.

The most heavily concentrated loans in the Loop were commercial and industrial loans, 85 percent.[72/] This high percentage is primarily a result of the concentration of large commercial banks in the Loop. Of the eleven commercial banks in the SMSA with deposits in excess of $200 million in 1968, eight were located in the Loop. Businesses that require large amounts of capital will generally obtain loans from larger banks, because only these banks have

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72/ The percentages of bank activities shown in Table 9 are based on dollar volumes. As discussed in Chapter III above, dollar amount may serve as an indication of "output," but the "output" is not homogenous among banks. This output measure does not indicate activity per account, average balance, length of deposit, etc. Likewise, no indication of the average size or the riskiness of loans is provided. Thus, percentages of concentration may not measure homogenous services.

TABLE 9

PERCENTAGE DISTRIBUTION OF SELECTED ECONOMIC FACTORS AND COMMERCIAL BANK SERVICES BY SUBAREA OF THE CHICAGO SMSA 1/

	Loop			City of Chicago, Excluding Loop			Larger Suburbs			Remainder of SMSA			
	Share of SMSA Total 2/		Growth In Area 3/	Share of SMSA Total 2/		Growth in Area 3/	Share of SMSA Total 2/		Growth in Area 3/	Share of SMSA Total 2/		Growth In Area 3/	Total SMSA Growth
	1962	1968		1962	1968		1962	1968		1962	1968		
Total Bank Assets	64.1 %	64.4 %	64.3 %	19.5 %	17.0 %	43.3 %	13.4 %	14.8 %	81.4 %	3.1 %	3.8 %	104.0 %	63.7 %
Commercial and Industrial Loans	83.8	84.8	113.1	10.7	8.6	69.3	4.8	5.5	142.8	0.7	1.1	215.9	110.6
Demand Deposits, IPC	66.1	64.8	32.7	18.0	16.9	27.0	13.2	14.7	51.2	2.7	3.6	82.7	35.5
Savings Deposits	43.4	35.7	7.8	31.9	31.6	29.9	20.1	26.3	71.0	4.6	6.5	85.7	31.1
Loans to Individuals	40.4	36.9	58.9	30.7	25.6	45.2	24.4	29.6	110.5	4.5	7.9	207.3	74.0
Real Estate Loans	28.6	30.1	117.6	33.6	27.9	71.1	29.3	32.8	131.9	8.5	9.2	124.3	106.7
Population	.1	.4	309.5	55.0	50.8	- 0.3	27.2	30.8	22.0	17.6	18.0	10.6	8.1
Total Employment	17.3	15.4	6.0	49.8	44.6	6.7	23.2	26.9	38.4	9.7	13.1	61.3	19.2
Manufacturing Employment	2.9	4.9	92.2	57.3	49.7	- 1.6	28.0	31.2	26.3	11.8	14.2	36.5	13.4
Nonmanufacturing Employment	29.2	23.4	- 1.0	43.7	40.8	15.7	19.2	23.7	52.9	7.9	12.2	91.9	23.9
Number of Banks	5.0	5.4	23.1	24.7	23.8	9.4	43.6	42.9	11.5	26.6	27.9	18.8	13.5

1/ Bank loan, deposit, and asset percentages are based on dollar volume.

2/ Portion of SMSA activity within the subarea.

3/ Percentage change in the level of activity between 1962 and 1968.

loan portfolios large enough to permit the bank to maintain a diversified portfolio and still extend large amounts of credit to an individual customer. In addition, Illinois and national banking statutes limit the size of a loan made to any one customer to 15 and 10 percent, respectively, of a bank's capital plus surplus.[73/] Thus business loans would be expected to be concentrated where major banks are located.

Less concentrated were real estate loans, 30 percent in Loop banks, and loans to individuals, 37 percent. This also conforms with our expectations. The market areas for real estate loans, especially home mortgages, should be concentrated at the site's neighborhood banks, since they require the bank to travel to the site to inspect construction or the condition of the existing building to be purchased.[74/] The location of the Loop at the eastern edge of the SMSA and the large geographic size of the metropolitan area mean that Loop banks have relatively higher costs of servicing loans on property in outlying areas of the SMSA. The concentration of loans to individ-

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73/ Loan limits on real estate loans are determined by somewhat different requirements.

74/ Developers of residential and commercial subdivisions often arrange financing for the entire project with one financial institution. Closeness to the construction site is not as important a factor in negotiating these loans, since large loan amounts are involved.

uals was low, because negotiating these loans does not require the expertise of large commercial loans and the small dollar amounts generally involved enable all banks to engage in this type of lending.

IPC demand deposits were more concentrated in the Loop than were savings accounts. In 1968, 65 percent of the dollar volume of IPC demand deposits and 36 percent of savings deposits were with Loop banks. The high IPC demand deposit share may be due to the concentration of business checking accounts in Loop banks from which they have loans.[75/] The large size of these accounts may overwhelm the deposits of individuals and obscure their spatial distribution. Unfortunately, it was not possible to segregate business accounts from household accounts.[76/] On the other hand, savings accounts are generally held by households, for whom convenience is a more important criterion for bank choice than is size of bank. Thus these deposits, as expected were less concentrated in CBD banks.

Chicago banks outside of the Loop were more oriented to households' than to business firms' demands. In 1968, these banks held over one-fourth of the dollar volume of real estate loans and loans to individuals but only nine percent of business loans. Growth of population and employment was far below levels of the rest of the SMSA.

75/ Very often compensating deposit balances are required when loans are extended to firms.

76/ Data does exist by size of deposit account, however. See page 84.

Nonmanufacturing employment was becoming increasingly important in the larger suburbs in the six year period. Nonmanufacturing employment accounted for 45 percent of total employment in 1962 and more than half the jobs in 1968. This reflects the establishment of new retail and service firms in response to the continuing growth of population in these suburbs, which account for 31 percent of the SMSA population. The relatively small size of banks in these areas was indicated by their comparatively smaller shares of bank activities. In 1968, these banks had only 15 percent of total assets. Similar to Chicago banks outside of the Loop, they have a relatively higher share of services to households than to businesses.

The less populated areas of the SMSA had less than one-fifth of the population, 13 percent of the employment[77/], but 28 percent of the banks. These banks were generally very small, accounting for only four percent of the total assets of SMSA banks. The percentage of each bank service originating at rural banks was less than half of the area's share of SMSA population.

Between 1962 and 1968, the population of the SMSA increased by 8 percent, and employment rose at more than twice that rate. The

77/ The rapid growth in rural employment indicated in Table 9 overstates the true gains. Employment includes only workers covered under the Illinois Unemployment Compensation Act, thus excluding farm workers. Since suburban and rural areas are experiencing a shift from agricultural to other types of industries, corresponding shifts of workers from agriculture are counted as employment gains in the data.

number of banks increased by 14 percent while bank assets grew by 64 percent. The three types of loans listed in Table 9 had growth rates more than twice that of demand and savings deposits, and significantly higher than bank assets. The more rapid growth of banking activity than of population and employment reflects, in part, the improved strength of the national economy. In 1962, the recovery from the February 1961 recession trough had just begun, and by 1968 a strong expansion was in progress.

Between 1962 and 1968, the Loop increased its share of bank assets, real estate loans, and commercial loans. The growth of loans to individuals and demand deposits in Loop banks was slightly below that of the SMSA as a whole. Savings deposits were the only service for which Loop banks experienced significantly slower growth than the SMSA as a whole. This may not reflect a loss of customers, however, but the shift by depositors from savings accounts to time deposits, more commonly referred to as certificates of deposit (CDs), which came into widespread use during the period. Between December 31, 1962 and December 31, 1968 savings deposits at Loop banks rose by $159 million. Time deposits of individuals, partnerships, and corporations at these banks more than quadrupled in the same period, increasing from $741 million to $3,112 million.

The continuing importance of the Loop as the financial center of the SMSA was also evident by the fact that three of the eleven new banks established in Chicago during the six year period located in the Loop. In addition, each of the three bank mergers that occurred in the City of Chicago involved Loop banks with the Loop bank site serving as the resulting bank office.[78/] In two cases, the absorbed banks were located in areas which had rapidly become Black residential areas, and the third bank was located near the Chicago stockyards, which has experienced declining activity in recent years.

The growth rates of population, employment, and bank activity in the larger suburbs were greater than those for the SMSA in all categories except number of banks. Suburban employment grew by 38 percent, twice as fast as population. Bank assets increased by 81 percent, faster than the rises in demand and savings deposits but less than loan growth. In most categories of bank activity, banks in Chicago outside of the Loop had the smallest growth of all subareas, while banks in the rural areas grew nearly twice as fast as SMSA banks as a whole.

A central place hierarchy of bank services was evident. Loop banks had the greatest share of SMSA activity in the more specialized financial activities. These banks serve customers, primarily large corporations, who obtain loans and invest funds in regional and national money markets. Thus, the highest activity concentration in the Loop was commercial and industrial loans, 85 percent. In the

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78/ Because of the mileage between the banks involved, Illinois unit banking restrictions required that one bank office be closed.

lowest ordered central places in the SMSA, the share of SMSA activity was relatively greatest for those services primarily used by households -- real estate loans, loans to individuals, and savings deposits.

Data from the survey of deposit accounts of individuals, partnerships, and corporations (IPC) in June 1968 revealed this central place hierarchy of bank services more clearly. For each of the commercial banks in the SMSA the number of IPC deposit accounts with balances less than $1,000; from $1,001 to $20,000; from $20,001 to $100,000; and over $100,000 were available. In Table 10, the percentages of SMSA bank accounts in each size class are given for the four major subareas. The concentration of major corporations' accounts in financial district banks was clearly evident. While Loop banks held 75 percent of accounts with balances exceeding $100,000, they held only 30 percent of accounts with balances under $1,000. The opposite relation was true for rural SMSA banks.

TABLE 10

CONCENTRATION OF IPC DEPOSIT ACCOUNTS
BY SIZE OF ACCOUNT

Chicago SMSA, June 1968

	Percentage of SMSA Accounts Held by Banks in			
Balance in Account	Loop	Chicago Outside of Loop	Larger Suburbs	Rural Areas
All Accounts	31.0%	24.6%	33.3%	11.1%
$1,000 or Less	29.6	24.2	34.2	11.9
$1,001 to $20,000	32.6	26.1	31.8	9.5
$20,001 to $100,000	54.0	20.9	19.8	5.3
Over $100,000	74.9	13.8	9.4	1.9

Source: Summary of Deposits, Banks and Branches, June 30, 1968.

This central place hierarchy of services was also evident in the distribution of commercial banks offering trust services (see Table 11). In 1968, eleven of the sixteen Loop banks offered trust services, and these banks received 91 percent of the total trust department income of Chicago SMSA banks. The much smaller size of the trust departments at banks elsewhere was indicated by their relatively small share of trust income compared with their share of the number of banks offering trust services. Trust services were available at only one-fifth of the banks in rural areas.

TABLE 11

CONCENTRATION OF COMMERCIAL BANK TRUST SERVICES

Chicago SMSA, 1968

Trust Activity	Subarea Loop	Chicago Outside of Loop	Larger Suburbs	Rural Areas	SMSA TOTAL
Total Number of Banks	16	70	126	83	295
Banks Offering Trust Services	11	26	59	18	114
Percent of Banks in Area	68.8%	37.1%	46.8%	21.7%	38.6%
Percent of Banks in SMSA with Trust Services	9.6%	22.8%	51.8%	15.8%	100.0%
Trust Department Income					
Millions of Dollars	$64.8	$3.2	$3.2	$0.2	$71.4
Percent of SMSA Total	90.7%	4.5%	4.5%	0.3%	100.0%

Source: Reports of Income and Dividends, December 31, 1968.

The operation of a trust department requires time and expertise that managers of smaller banks generally do not have. With fewer personnel, managers must be involved with nearly all aspects of the bank's operations, while larger banks can operate specialized departments. Smaller banks also may not provide trust services because of insufficient demand. A relatively small proportion of households establish trusts as compared with more common banking services, such as checking accounts. Since the costs of hiring personnel to provide these services are high, a minimum or threshold level of output is required to make the provision of the service profitable. These factors and the location of most major banks in the central city, especially the main financial district, explain the concentration of trust services at banks in the Loop.

Estimation Procedures

Demand equations for the six bank services were estimated for 1962 and 1968. Separate cross-section runs were made for each year for the City of Chicago and the Suburbs, as well as these areas combined. In the original least squares regressions the 75 community areas of Chicago and the 66 larger suburbs were used as observations.[79/] However, after examining the results the Loop and subareas which did not contain a bank were omitted. Relatively large shares of SMSA banking activity occurred at Loop banks compared with the concentration of other variables (see Table 9), and a large number of subareas did not have a commercial bank thereby making the observed value

79/ See Appendix B for list of Chicago Community Areas and Suburbs considered in this study.

of the dependent variable equal to zero.[80/] Including these areas merely forced the regression through the Loop and nonbank area observations, and did not capture the effects of the independent variables in other subareas. Thus, the Loop and those areas without a bank in both years were excluded.

The number of banks was used to measure competition, COMP. However, a high degree of correlation between COMP and several independent variables was indicated (see Table 12). This relationship likely results from the fact that a bank's location decision is based on estimates of demand for its services by local businesses and residents. Thus, number of banks was not a satisfactory measure of competition. In studies of bank performance, concentration are ratios frequently used to indicate competition. In this study, these ratios could not be calculated because of the small number of banks in each subarea.[81/] Because of the lack of an appropriate measure, COMP was dropped from the estimated demand equations.

80/ Of the 141 subareas in the study, 36 did not have a commercial bank in 1962 and 33 were without banks in 1968.

81/ The mean number of banks in areas with a bank, the Loop excluded, was 1.72 in 1962 and 1.85 in 1968.

TABLE 12

BANK COMPETITION VARIABLE, COMP,
SIMPLE CORRELATION COEFFICIENTS EXCEEDING .600

Regression Set	Correlated Variable	Correlation Coefficient 1962	1968
Chicago	NMFG	.694	.725
	$NMFG^2$	.657	.721
	PCOMP	a/	.611
Suburbs	POP	.819	.706
	POP^2	.801	.703
	NMFG	.813	.736
	$NMFG^2$	.740	.640
SMSA b/		None	None

a/ Correlation in 1962 was .542.

b/ Includes all subareas contained in either Chicago or Suburbs.

Three forms of weighting the demographic potential variables, PPOP, PEMP, and PCOMP were used.[82/] These were:

$$V_i = G \sum_j \frac{X_j}{d_{ij}} \qquad j=1,\ldots,J; J = \text{number of subareas adjacent to area } i$$

82/ For PPOGR, the simple arithmetic mean of the annual rates of population growth in adjacent areas was used.

$$V_i = G \sum_j \frac{X_j}{d_{ij}^2}$$

$$V_i = G \sum_j X_j^{-d_{ij}}$$

The first form was adopted since it gave better regression results in terms of t values of the coefficients and the F ratio of the regression equations.

The residuals were plotted for each of the equations estimated, and the variance of the residuals was found to increase with the size of the dependent variable. Therefore, squared values of five independent variables were introduced into the regressions: POP^2, MFY^2, $NWHT^2$, MFG^2, and $NONMFG^2$. Inclusion of these variables removed the heteroscedasticity.

Stepwise regressions were run incorporating the adjustments just described. Since one of the aims of the study was to determine constancy of the structure equations between 1962 and 1968 and between Chicago and Suburban areas, only those variables obtaining a specified level of statistical significance were included for further analysis. These variables were chosen as follows:

1. For each of the six demand equations, stepwise regressions were run for the six sets of observations:

   Chicago subareas 1962
   Chicago subareas 1968
   Suburban areas 1962
   Suburban areas 1968
   SMSA 1962 (Chicago & Suburb areas combined)
   SMSA 1968 (Chicago & Suburb areas combined)

   The Loop and all areas without banks were excluded from these regression sets.

2. At each step of the regression, the significance of the regression coefficient on the entering independent variable was determined. If the coefficient was significant at the 90 percent confidence level the variable was included. Otherwise, the variable was excluded and no further steps in the regression were considered.

3. Variables which were chosen for inclusion in any of the six subarea demand equations were retained in the final regression runs for that bank service.

In the following section of this chapter the results of the demand estimations for each of the six services are described. Then the results of Chow tests to determine the constancy of the structure estimations over areas and time are given.

Least Square Regression Results

The variables included in the demand equation estimations are given in Table 13 with their symbols repeated for reference.[83/] All of the twenty hypothesized variables appeared in at least one of six final demand estimation runs. The results of the estimation of demand equations for each of the six bank services are summarized in turn in the remainder of this section.

TABLE 13

INDEPENDENT VARIABLES INCLUDED IN REGRESSION ANALYSIS

Symbol	Variable Name	Scale of Variable
POP	Population	1,000
POP^2	$(\text{Population})^2$	1,000,000
PPOP	Population Potential	1,000
MFY	Median Family Income	\$100
MFY^2	$(\text{Median Family Income})^2$	\$10,000
AGE	Percent of Population 18-64 Years of Age	percentage
NWHT	Percent of Population Nonwhite	percentage
$NWHT^2$	$(\text{Percent of Population Nonwhite})^2$	percentage
POPGR	Annual Rate of Population Growth	percentage
PPOPGR	Growth Potential	percentage
EMP/POP	Ratio of Employment to Population	actual level
MILP	Miles to Loop	miles
MFG	Manufacturing Employment	100
MFG^2	$(\text{Manufacturing Employment})^2$	10,000
NMFG	Nonmanufacturing Employment	1,000
$NMFG^2$	$(\text{Nonmanufacturing Employment})^2$	1,000,000
PEMP	Employment Potential	1,000
PCOMP	Competition Potential	actual level
MMKT	Money Market Dummy	0, 1 variable

83/ See Appendix A for complete description of data sources.

<u>Total Assets</u> - All of the hypothesized determinants of overall demand for bank services were chosen for inclusion in the final demand function estimates. The results of the demand estimations for Chicago, Suburbs, and SMSA runs for both 1962 and 1968 are given in Table 14.

Results for the Chicago regression sets are poorer than for the Suburbs or SMSA. For Chicago 1962, only the coefficient on MMKT was statistically significant, yet the R^2 was .887. In the 1968 Chicago run, AGE and PPOPGR also were significant and had positive coefficients. The absence of any significant influence on demand by most demographic variables likely reflects the fact that Chicago had been experiencing rapid changes in the nature of its economic activity in the last two decades, as business firms and middle and upper income families moved to the suburbs. Since surveys indicate customers are generally loyal, many may have maintained older banking connections in the city after their move. This would be especially true of business firms that require services often available only at larger banks and that rank convenience as a less important criterion for choice of bank. The importance of the bank size variable in the regression gives evidence to this view. Since the demand equations were framed in static form, the transition to the new long-run equilibrium distribution of bank services was not captured in the model.

TABLE 14

TOTAL ASSETS
REGRESSION RESULTS[a/]
(Dependent Variable in Millions of Dollars)

Independent Variables	Chicago 1962	Chicago 1968	Suburbs 1962	Suburbs 1968	SMSA 1962	SMSA 1968
Intercept	-300.512	-538.479	16.706	-90.749	-230.064	-579.910
POP	-1.889 *-0.89*	1.608 *0.81*	0.037 *0.07*	-1.628 *-1.43*	1.195** *2.67*	1.399* *1.76*
POP^2	0.013 *1.13*	-0.007 *-0.57*	0.001 *0.34*	0.026** *2.14*	-0.004 *-1.47*	-0.007 *-1.33*
PPOP	-0.104 *-0.44*	0.102 *0.33*	0.559** *2.83*	0.719** *3.37*	-0.124 *-1.27*	-0.111 *-0.75*
MFY	3.698 *0.30*	-4.026 *-0.51*	0.540 *1.17*	0.983** *2.44*	1.437** *2.16*	2.197** *3.55*
MFY^2	-0.021 *-0.27*	0.028 *0.61*	-0.002 *-0.94*	-0.002** *-2.12*	-0.005* *-1.93*	-0.006** *-3.10*
AGE	3.512 *0.96*	10.058** *3.07*	-0.839 *-0.77*	1.066 *0.99*	2.238* *1.99*	6.330** *4.42*
$NWHT^2$	0.002 *0.32*	-0.0001 *-0.02*	-0.005 *-0.25*	0.002 *0.19*	-0.001 *-0.53*	0.002 *0.61*
POPGR	-9.746 *-1.21*	-0.613 *-0.04*	-0.307 *-1.56*	-2.458** *-2.59*	-0.012 *-0.04*	-0.464 *-0.29*
PPOPGR	2.833 *0.73*	23.825** *2.57*	-0.189 *-1.26*	-0.916 *-1.05*	-0.127 *-0.53*	1.581 *1.01*
EMP/POP	-27.136 *-1.17*	10.737 *0.45*	-33.468 *-0.80*	-58.760* *-1.75*	-3.832 *-0.30*	-4.605 *-0.29*
MILP	2.214 *0.33*	0.412 *0.06*	0.190 *0.52*	0.496 *1.13*	0.661 *1.40*	2.093** *3.02*
MFG	0.197 *0.53*	0.0003 *0.001*	-0.101 *-0.41*	0.206 *0.97*	-0.131 *-0.98*	-0.071 *-0.39*
MFG^2	-0.001 *-0.86*	-0.0004 *-0.45*	-0.0002 *-0.54*	-0.001* *-1.98*	0.00004 *0.13*	-0.0002 *-0.51*
NMFG	2.968 *1.18*	2.791 *0.96*	15.699** *3.97*	11.579** *3.31*	4.498** *3.81*	6.296** *3.81*
$NMFG^2$	0.016 *0.40*	-0.020 *-0.70*	-0.420* *-1.811*	-0.222 *-1.33*	-0.020 *-1.43*	-0.033* *-1.93*
PEMP	0.133 *0.53*	0.185 *0.58*	0.441 *0.91*	-0.116 *-0.25*	0.208 *1.56*	0.422** *2.40*
PCOMP	3.844 *0.45*	-4.280 *-0.45*	-13.328** *-3.77*	-17.850** *-4.46*	-0.402 *-0.14*	-0.858 *-0.20*
MMKT	132.987** *4.59*	166.632** *6.78*	57.860** *2.25*	103.787** *6.32*	107.394** *9.18*	148.012** *10.101*
R Square	.887	.930	.890	.934	.848	.858
F Value	8.307	14.075	20.185	35.396	25.675	27.902
Number of Observations	38	38	64	64	102	102

a/ Regression coefficient and t-value (in italics)

* Coefficient significant at 90 percent confidence level.

** Coefficient significant at 95 percent confidence level.

The rate of population growth had a sizeable negative effect on suburban demand, especially in 1968. This reinforces the hypothesis that bank customers tend to be loyal, and do not change banks, especially over the short run when they move within the metropolitan area. The negative sign on the growth variable in suburban areas and the significant positive coefficient on Chicago PPOPGR, conform with the hypothesis that a lag occurs between the observed growth of an area and the time when new residents transfer their accounts to banks in their new neighborhood.

For suburban areas, the population and income variables had the hypothesized positive effects on demand. Unlike Chicago runs, AGE was not a significant factor. Neither percentage of the population nonwhite nor miles to the Loop were significant. The negative value of the EMP/POP coefficient in suburban areas implies that suburbanites tend to bank where they live rather than where they work. The level of nonmanufacturing employment affected demand positively, while manufacturing employment decreased demand.

The negative sign on the MFG coefficient in the suburbs and its insignificance in both the Chicago and SMSA runs may arise from two factors. First, employees in manufacturing plants frequently have credit unions available as alternative sources of loan and deposit services. Secondly, management of manufacturing firms probably chooses banks more by their ability to meet credit demands and demands for specialized services than by convenience, because of the greater capital and smaller cash-on-hand requirements of these firms.

Results given in Table 14 indicated that the greater the number of banks in adjacent suburbs, the smaller the quantity of services demanded of banks within a suburb. This agrees with the hypothesis that households choose the most convenient bank. The positive sign on MMKT reflects the ability of larger suburban banks to attract customers from a wide area.

The total asset demand regression results for the SMSA differed slightly from the Chicago and Suburb areas run separately. As in the other two sets, nonwhite population had no significant effect on SMSA demand for all bank services. Population, median family income, nonmanufacturing employment, and bank size had strong positive effects on demand as they did for Suburbs runs. Similar to Chicago runs, EMP/POP, MFG, and PCOMP had no significant effect, and AGE increased demand.

Two variables entered SMSA runs differently than in the Chicago or Suburbs. Population growth was no longer significant, while a lagged response to bank services demanded as customer location changed was implied in the Chicago and suburban total asset regression. MILP did not significantly affect demand in either of the two subarea runs, however, it had a positive influence in the

1968 SMSA regression. This may indicate that location exerts a differential effect on demand in Chicago and Suburb areas but not within each of these subareas.

In summary, demand for all bank services combined, as measured by total assets, was explained by the hypothesized variables successfully for suburbs and the SMSA areas. However, most demographic variables had no significant effect on demand for services at Chicago City banks. This may be because of the static nature of the demand equation estimated in contrast to the rapid change in the distribution of SMSA economic activity. All variables with significant t values had the hypothesized signs except manufacturing employment, which had a negative influence on demand. Results indicated that large banks anywhere in the SMSA were able to attract deposits from outside their suburb or community area and that suburban residents tend to bank where they live rather than work.

Commercial and Industrial Loans - The variables selected for inclusion in the commercial and industrial loan (C&I loans) demand equation estimates are given in Table 15. The ratio of employment to population was the only hypothesized variable not included in the equations through the procedure described above.[84/]

84/ See page 90.

TABLE 15

COMMERCIAL AND INDUSTRIAL LOANS
REGRESSION RESULTS[a/]

(Dependent Variable in Millions of Dollars)

Independent Variables	Chicago		Suburbs		SMSA	
	1962	1968	1962	1968	1962	1968
Intercept	-31.722	-47.862	-0.567	-26.572	-34.348	-70.427
POP	0.060 *1.18*	-0.064 *-0.79*	0.025 *0.442*	0.020 *0.43*	0.058** *2.15*	-0.043 *-1.06*
PPOP	-0.056 *-1.44*	0.061 *1.00*	0.114** *3.31*	0.122** *3.75*	-0.017 *-1.03*	-0.009 *-0.37*
MFY	0.275 *0.16*	-0.670 *-0.45*	0.010 *0.12*	0.122** *1.83*	0.148 *1.28*	0.266** *2.50*
MFY^2	0.001 *0.07*	0.004 *0.49*	-0.00003 *-0.10*	-0.0003* *-1.76*	-0.001 *-1.25*	-0.001** *-2.35*
AGE	0.349 *0.62*	0.924 *1.56*	-0.010 *-0.05*	0.355** *2.11*	0.420** *2.27*	0.773** *3.31*
NWHT	0.111 *1.42*	0.131** *2.02*	-0.015 *-0.21*	0.081 *1.40*	0.062* *1.88*	0.132** *3.57*
POPGR	-0.068 *-0.07*	3.101 *1.15*	-0.030 *-0.90*	-0.266* *-1.80*	0.026 *0.55*	0.071 *0.27*
PPOPGR	-0.021 *-0.04*	2.522 *1.38*	-0.024 *-0.91*	0.066 *0.47*	-0.026 *-0.64*	0.450* *1.73*
MILP	-1.254 *-1.16*	0.873 *0.70*	0.055 *0.87*	0.051 *0.74*	0.082 *1.06*	0.319** *2.80*
MFG	0.070 *1.26*	-0.013 *-0.20*	-0.028 *-1.48*	0.009 *0.44*	-0.012 *-0.62*	-0.020 *-0.74*
MFG^2	-0.0002 *-1.47*	0.00004 *0.23*	-0.00003 *-0.60*	-0.0001 *-1.55*	-0.000 *-0.03*	0.00002 *0.33*
NMFG	-0.424 *-1.03*	0.572 *1.04*	0.669 *1.17*	0.465 *1.12*	0.272 *1.48*	0.829** *3.31*
$NMFG^2$	0.012* *1.92*	-0.006 *-1.11*	0.019 *0.54*	0.021 *1.17*	0.001 *0.28*	-0.006** *-2.11*
PEMP	-0.006 *-0.15*	0.094 *1.49*	0.003 *0.04*	-0.152** *-2.26*	0.029 *1.35*	0.104** *3.61*
PCOMP	1.384 *1.05*	-0.155 *-0.08*	-1.945** *-3.33*	-2.450** *-3.83*	0.314 *0.66*	0.254 *0.36*
MMKT	15.010** *4.15*	20.709** *4.26*	-2.775 *-0.68*	19.165** *7.52*	13.816** *6.90*	19.850** *7.98*
R Square	.842	.863	.673	.871	.751	.796
F Value	6.990	8.273	6.033	19.874	16.040	20.708
Number of Observations	38	38	64	64	102	102

a/ Regression coefficient and t-value (in italics)
* Coefficient significant at 90 percent confidence level.
** Coefficient significant at 95 percent confidence level.

Surprisingly, variables characterizing the residential population contributed more to the determination of demand for C&I loans than did the employment variables, which had been used as proxy determinants of firms' demands for credit and financial services. Nonmanufacturing employment had a significant positive effect on demand in only two of the six subarea regressions, employment in adjacent areas had both positive and negative effects, and manufacturing employment never had a significant coefficient. The inability of employment variables to capture the nature of demand for credit by firms was not altogether unexpected, since as discussed above,[85/] the relationship between employment and output, capital, cash flows, firm growth, and other determinants of credit demand vary not only by the nature of the product produced by the firms, but also among firms in the same industry.

The significance obtained by several of the population characteristic variables implied that they may characterize the type of production in a neighborhood more so than employment levels. Zoning laws, easy access by customers, and agglomerative economies to firms often create factors which induce certain types of firms and

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85/ See page 66.

households to locate in the same neighborhoods. For example, retail and service businesses will be more concentrated in more heavily populated, higher income areas, thus the positive signs on POP and MFY. Nonwhite families are often only able to afford housing in older areas of the city where manufacturing plants are located. This was also indicated by our results since NWHT had a significant positive effect on demand at Chicago banks but not at suburban banks.

Since the desired indicators of credit demands by firms were not available and the proxy variables did not serve to adequately measure demand, the estimates of demand for C&I loans must be viewed with caution. However, the strong positive influence of bank size, MMKT, does reinforce evidence that locational factors are less important in business firms' choice of banks.

IPC Demand Deposits - Results of estimation of demand for IPC Demand Deposit accounts closely paralleled those of total asset regressions. As noted in Table 16, AGE, PPOPGR, and NMFG had significant positive effects on demand at Chicago banks and, with MMKT, were the only significant variables. Suburban demand was positively related to POP^2, PPOP, MFY, nonmanufacturing employment, and MMKT as hypothesized. The negative coefficient on the growth variables, POPGR and PPOPGR, indicate further evidence of a lag in growth in demand at suburban banks in response to decentralization of economic

TABLE 16

IPC DEMAND DEPOSITS
REGRESSION RESULTS[a]
(Dependent Variable in Millions of Dollars)

Independent Variables	Chicago 1962	Chicago 1968	Suburbs 1962	Suburbs 1968	SMSA 1962	SMSA 1968
Intercept	-91.221	-332.532	2.254	-19.572	-17.718	-181.174
POP	0.253	0.455	0.127	-0.600	0.594**	0.446
	0.32	*0.54*	*0.56*	*-1.49*	*3.37*	*1.38*
POP^2	0.0003	-0.002	0.001	0.010**	-0.002*	-0.003
	0.06	*-0.35*	*0.50*	*2.31*	*-1.66*	*-1.40*
PPOP	0.091	0.147	0.216**	0.194**	0.010	-0.099
	1.04	*1.13*	*2.59*	*2.61*	*0.26*	*-1.64*
MFY	3.238	1.430	0.230	0.326**	0.562**	0.728**
	0.82	*0.44*	*1.15*	*2.25*	*2.11*	*2.87*
MFY^2	-0.021	-0.010	-0.001	-0.001	-0.002*	-0.002**
	-0.81	*-0.52*	*-0.86*	*-1.96*	*-1.84*	*-2.48*
AGE	-0.863	3.453**	-0.308	0.198	-0.384	1.814**
	-0.67	*2.49*	*-0.67*	*0.52*	*-0.89*	*3.16*
NWHT	0.073	0.155	-0.019	0.028	-0.030	0.204**
	0.41	*1.09*	*-0.11*	*0.22*	*-0.39*	*2.30*
POPGR	-0.415	2.628	-0.114	-0.986**	-0.133	-0.096
	-0.14	*0.43*	*-1.36*	*-2.98*	*-1.24*	*-0.15*
PPOPGR	0.735	14.224**	-0.089	-0.532*	-0.074	0.662
	0.50	*3.62*	*-1.40*	*-1.74*	*-0.78*	*1.05*
EMP/POP	-6.442	6.390	-9.743	-23.763**	-1.451	-0.602
	-0.75	*0.63*	*-0.55*	*-2.01*	*-0.29*	*-0.09*
MILP	1.441	2.876	0.055	0.135	0.150	0.755**
	0.58	*1.04*	*0.35*	*0.87*	*0.82*	*2.73*
MFG	0.053	0.008	-0.050	0.088	-0.040	-0.063
	0.38	*0.05*	*-0.48*	*1.17*	*-0.76*	*-0.86*
MFG^2	-0.0002	-0.0001	-0.0001	-0.0003*	0.00004	0.00003
	-0.57	*-0.38*	*-0.36*	*-1.91*	*0.28*	*0.19*
NMFG	1.221	2.145*	6.008**	4.757**	1.307**	2.742**
	1.31	*1.75*	*3.57*	*3.88*	*2.82*	*4.10*
$NMFG^2$	0.008	-0.017	-0.175*	-0.140**	-0.001	-0.016**
	0.54	*-1.39*	*-1.78*	*-2.38*	*-0.26*	*-2.31*
PEMP	-0.061	0.053	0.143	-0.026	-0.060	0.235**
	-0.66	*0.39*	*0.70*	*-0.16*	*-1.15*	*3.30*
PCOMP	-3.233	-1.014	-5.506**	-5.473**	-1.230	1.239
	-1.01	*-0.25*	*-3.68*	*-3.91*	*-1.11*	*0.73*
MMKT	29.567**	49.086**	11.659**	29.955**	29.477**	41.542**
	2.75	*4.71*	*1.05*	*5.18*	*6.37*	*6.99*
R Square	.857	.922	.876	.923	.803	.834
F Value	6.332	12.448	17.670	30.100	18.773	23.195
Number of Observations	38	38	64	64	102	102

a/ Regression coefficient and t-value (in italics)
* Coefficient significant at 90 percent confidence level.
** Coefficient significant at 95 percent confidence level.

activity. EMP/POP had a significant negative coefficient implying persons maintain checking accounts at banks near their homes rather than work places. PCOMP had the expected inverse relation with demand.

Manufacturing employment had a negative effect on demand, as it did for most other services when it did have a significant coefficient. It is interesting to note that Tulpule dropped manufacturing employment from his regressions explaining employment in financial firms because of its insignificant effect.[86/]

The SMSA runs generally agreed with the two other subarea demand regressions; population, income, age, nonmanufacturing employment, and bank size were positively related to demand. Unlike the two subarea runs, however, percentage of the population nonwhite and miles to the Loop had significant positive influences on demand for checking accounts by households and businesses. As mentioned above, to the extent that Black households reside in industrial areas, this variable may capture demands by manufacturing firms rather than by households. The positive MILP coefficient was consistent with the hypothesis that convenience is important in bank choice, and while a longer trip to the larger banks in the Loop

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86/ See Page 17 above.

may be undertaken in order to obtain a more specialized or better quality service, once this distance becomes too great customers no longer view Loop banks as alternatives. The greater demands for local bank checking accounts in outlying SMSA areas may also reflect the fact that a greater proportion of Chicago residents likely work in the Loop than do suburban residents. Thus the Chicago residents are more likely to use Loop banks than are suburbanites.

In the three IPC demand deposit regressions, all variables entered and had the hypothesized signs except for MFG which was inversely related to demand. Large banks anywhere appeared to attract accounts from outside their immediate neighborhood and a lagged response of demand at suburban banks to decentralization of households and businesses was indicated.

Savings Deposits - Demand for savings accounts at Chicago banks was more closely related to demographic variables than demand for other bank services (see Table 17). This reflects the fact that this service is held almost exclusively by households and so accounts of business firms are not included in the aggregate deposit figures to obscure household deposit levels. MILP was not chosen for inclusion as it was in other demand equations, and EMP/POP did not obtain

TABLE 17

SAVINGS DEPOSITS
REGRESSION RESULTS[a/]
(Dependent Variable in Millions of Dollars)

Independent Variable	Chicago		Suburbs		SMSA	
	1962	1968	1962	1968	1962	1968
Intercept	340.968	-122.054	5.098	-40.469	-79.537	-176.617
POP	-2.356**	0.566	0.189	0.134	0.615**	0.860**
	-2.29	*0.61*	*0.96*	*0.52*	*2.84*	*3.05*
POP^2	0.015**	-0.001	-0.0004	0.0005	-0.001	-0.003
	2.66	*-0.23*	*-0.29*	*0.16*	*-0.67*	*-1.32*
PPOP	-0.071	0.074	0.307**	0.311**	0.026	0.043
	-0.73	*0.56*	*4.44*	*5.59*	*0.58*	*0.80*
MFY	-11.615*	-2.887	0.274	0.300**	0.495	0.870**
	-1.95	*-0.77*	*1.26*	*2.12*	*1.37*	*3.41*
MFY^2	0.077*	0.022	-0.001	-0.001	-0.002	-0.002**
	2.00	*1.00*	*-1.06*	*-1.58*	*-1.19*	*-2.91*
AGE	3.478*	3.417**	-0.392	0.447	0.854	1.924**
	1.99	*2.18*	*-0.79*	*1.25*	*1.44*	*3.27*
$NWHT^2$	-0.007**	-0.002	0.002	0.002	-0.003**	-0.003**
	-2.15	*-1.21*	*0.30*	*0.66*	*-2.50*	*-2.95*
POPGR	-8.440**	-3.597	-0.164*	-0.677**	-0.047	-0.327
	-2.63	*-0.54*	*-1.86*	*-2.06*	*-0.31*	*-0.50*
EMP/POP	-17.186	1.539	5.003	-10.488	0.627	-0.002
	-1.56	*0.14*	*0.52*	*-1.47*	*0.10*	*-0.0003*
MFG	-0.035	-0.037	-0.151**	-0.040	-0.057*	-0.026
	-0.57	*-0.59*	*-4.70*	*-1.34*	*-1.77*	*-0.79*
NMFG	-0.216	0.184	4.266**	3.282**	0.676**	0.390
	-0.38	*0.34*	*4.41*	*6.19*	*2.60*	*1.36*
PCOMP	3.258	-3.070	-5.412**	-7.455**	-1.636	-3.135*
	0.87	*-0.67*	*-3.52*	*-5.61*	*-1.06*	*-1.82*
MMKT	82.010**	78.103**	23.565**	47.346**	48.339**	66.853**
	6.13	*7.10*	*2.36*	*8.63*	*7.60*	*11.31*
R Square	.781	.839	.852	.937	.739	.815
F Value	6.590	9.630	22.137	57.411	19.146	29.919
Number of Observations	38	38	64	64	102	102

a/ Regression coefficient and t-value (in italics)
* Coefficient significant at 90 percent confidence level.
** Coefficient significant at 95 percent confidence level.

significance at the 90 percent confidence level in any of the six runs, although it was chosen for inclusion in the stepwise regressions.

Demand for savings deposits at Chicago banks was positively related to population, income, age grouping, and bank size as hypothesized. Percentage of the population nonwhite was negatively related to demand, reflecting different saving habits of these two major racial groups. Unlike other services, demand at Chicago banks was inversely related to population growth. As discussed above, this may reflect the loss of this type of deposit as customers converted savings deposits into CDs, which were coming into widespread use at this time.

Demand for savings accounts at suburban banks was not significantly determined by POP, AGE, or NWHT. Unlike Chicago runs, however, employment variables were significant. Demand was directly related to nonmanufacturing employment, but inversely related to manufacturing employment, again perhaps reflecting the greater use of credit unions by manufacturing employees. Similar to Chicago runs, a negative relation between an area's growth and demand for savings deposits at its banks was indicated. Competition potential also affected demand inversely as expected.

Results of the SMSA runs agreed with the other two subareas. Population, income, percentage of the population 18-64 years of age, nonmanufacturing employment, and bank size were directly related to savings demands; and nonwhite population, competition potential, and manufacturing employment were inversely related to demand.

Loans to Individuals - Distance to the Loop had a significant positive influence on demands for loans to individuals in the three subareas (see Table 18). In the demand equations previously discussed, this variable had a significant effect only in SMSA regressions. The direct relation between MILP and demand may reflect the fact that households consider convenience more important when obtaining the service. Unlike savings accounts which may be opened and all transactions carried out by mail, a visit to the bank is generally necessary to negotiate a loan. Thus as MILP increases, customers are less likely to consider Loop banks as alternative sources of credit and will more likely request loans from local banks.

In Chicago, NMFG, PEMP, and MMKT had the expected significant positive effects on demand. Suburban personal loan demands were directly related to population, income, nonmanufacturing employment and bank size; and inversely related to POPGR, MFG^2, and PCOMP. Except for MFG^2 all suburban coefficients had the hypothesized signs. SMSA results agreed with the other subarea runs, except that AGE entered positively in the SMSA regression, while it was insignificant in the other two subareas.

TABLE 18

LOANS TO INDIVIDUALS
REGRESSION RESULTS[a/]
(Dependent Variable in Millions of Dollars)

Independent Variables	Chicago		Suburbs		SMSA	
	1962	1968	1962	1968	1962	1968
Intercept	-25.234	-68.136	3.859	-12.760	-34.796	-52.821
POP	-0.213	-0.071	0.068	-0.514**	0.173**	0.244*
	-0.74	*-0.22*	*1.04*	*-2.31*	*2.31*	*1.84*
POP^2	0.002	0.001	0.00003	0.009**	-0.001	-0.001
	0.98	*0.34*	*0.05*	*3.20*	*-1.39*	*-1.46*
PPOP	-0.042	-0.019	0.076**	0.139**	-0.052**	-0.041
	-1.02	*-0.29*	*2.15*	*2.91*	*-2.86*	*-1.42*
MFY	0.118	0.270	0.091	0.228**	0.194*	0.271**
	0.08	*0.17*	*1.16*	*2.52*	*1.83*	*2.44*
MFY^2	-0.001	-0.002	-0.0003	-0.001**	-0.001*	-0.001**
	-0.13	*-0.21*	*-0.95*	*-2.29*	*-1.67*	*-2.10*
AGE	0.260	0.568	-0.191	0.021	0.343*	0.407
	0.46	*0.83*	*-1.00*	*0.08*	*1.69*	*1.50*
POPGR	-1.216	-4.178	-0.036	-0.597**	0.020	-0.324
	-0.92	*-1.39*	*-1.06*	*-2.80*	*0.39*	*-1.07*
PPOPGR	-0.111	2.741	-0.035	-0.268	-0.035	-0.034
	-0.17	*1.41*	*-1.32*	*-1.33*	*-0.77*	*-0.11*
MILP	1.955*	2.677*	0.040	0.204**	0.116	0.388**
	1.74	*1.98*	*0.64*	*2.10*	*1.38*	*3.01*
MFG	0.023	-0.042	-0.023	0.005	-0.036*	-0.033
	0.36	*-0.58*	*-1.16*	*0.16*	*-1.70*	*-1.05*
MFG^2	-0.0002	-0.00003	-0.00004	-0.0002**	0.00001	-0.00002
	-1.32	*-0.16*	*-0.93*	*-2.37*	*0.20*	*-0.20*
NMFG	0.707	1.229**	1.284**	2.020**	0.940**	1.176**
	1.61	*2.05*	*2.19*	*3.11*	*4.43*	*3.95*
$NMFG^2$	0.003	-0.009	0.004	-0.063**	-0.006**	-0.007**
	0.39	*-1.45*	*0.12*	*-2.00*	*-2.08*	*-2.11*
PEMP	0.061	0.127*	0.033	-0.113	0.040*	0.073**
	1.44	*1.91*	*0.46*	*-1.17*	*1.66*	*2.21*
PCOMP	1.675	0.060	-1.625**	-2.144**	0.926*	0.573
	1.13	*0.03*	*-2.70*	*-2.32*	*1.77*	*0.71*
MMKT	11.156**	14.279**	15.764**	11.288**	12.134**	16.362**
	2.44	*2.68*	*3.92*	*2.96*	*5.56*	*5.44*
R Square	.833	.802	.861	.860	.748	.724
F Value	6.525	5.326	18.196	18.056	15.791	13.955
Number of Observations	38	38	64	64	102	102

a/ Regression coefficient and t-value (in italics)
* Coefficient significant at 90 percent confidence level.
** Coefficient significant at 95 percent confidence level.

Percentage of the population nonwhite and EMP/POP were not chosen for inclusion in the loans to individuals demand equation, implying no differential preference for bank loans by persons of different race and no tendency for persons to use banks closer to home rather than work place as a source of credit.

Real Estate Loans - The final service demand equation estimated was for real estate loans (see Table 19). NWHT was not chosen for entry into the real estate demand equation by the procedure outlined above.

In Chicago demand equations, distance from the Loop, nonmanufacturing employment, PPOP, and PEMP were positively related to demand as hypothesized, while MFG employment had a negative coefficient as in several other demand equations. The relation between real estate loan demand at Chicago banks and population growth was not clear. In 1962, POPGR entered with a significant negative coefficient, which would imply fewer real estate loans are demanded by residents in growing areas. This may indicate that persons moving into an area obtain credit from banks near their former places of residence. In the 1968 regression, real estate loan demand was positively related to growth in adjacent community areas.

Suburban demand was directly affected by population, income, and nonmanufacturing employment. PCOMP had the expected nega-

TABLE 19

REAL ESTATE LOANS
REGRESSION RESULTS[a]
(Dependent Variable in Millions of Dollars)

Independent Variables	Chicago		Suburbs		SMSA	
	1962	1968	1962	1968	1962	1968
Intercept	-36.314	-196.817	3.371	-20.538	-21.952	-87.383
POP	-0.012	0.616	-0.110	-0.580*	0.244**	0.457**
	-0.04	*1.66*	*-1.33*	*-1.78*	*3.11*	*2.76*
POP^2	0.0002	-0.003	-0.0001	0.007**	-0.001**	-0.003**
	0.14	*-1.47*	*-0.14*	*2.06*	*-2.69*	*-2.76*
PPOP	0.016	0.103*	0.074**	0.082	-0.015	-0.009
	0.45	*1.71*	*2.41*	*1.35*	*-0.85*	*-0.27*
MFY	0.595	1.903	0.076	0.230**	0.173*	0.388**
	0.47	*1.27*	*1.11*	*2.08*	*1.74*	*3.20*
MFY^2	-0.006	-0.012	-0.0003	-0.001	-0.001	-0.001**
	-0.63	*-1.33*	*-1.10*	*-1.89*	*-1.64*	*-2.77*
AGE	0.031	0.914	-0.082	0.255	0.187	0.805**
	0.06	*1.43*	*-0.49*	*0.83*	*0.98*	*2.71*
POPGR	-2.117*	-1.609	-0.049	-0.243	-0.040	-0.197
	-1.76	*-0.59*	*-1.60*	*-0.90*	*-0.84*	*-0.59*
PPOPGR	0.277	4.343**	-0.031	-0.146	-0.020	0.137
	0.48	*2.48*	*-1.33*	*-0.59*	*-0.46*	*0.42*
EMP/POP	0.276	6.767	-10.784	-17.467*	-0.180	0.962
	0.08	*1.44*	*-1.66*	*-1.82*	*-0.08*	*0.28*
MILP	2.966**	4.072**	0.023	0.126	0.087	0.440**
	2.97	*3.33*	*0.41*	*1.02*	*1.08*	*3.08*
MFG	-0.042	-0.127*	0.001	0.040	-0.036	-0.092**
	-0.74	*-1.80*	*0.03*	*0.66*	*-1.54*	*-2.41*
MFG^2	0.00001	0.0002	0.00001	-0.0001	0.0001	0.0002*
	0.05	*1.01*	*0.21*	*-0.75*	*1.34*	*1.79*
NMFG	0.685*	1.566**	3.488**	3.262**	0.436**	1.270**
	1.78	*2.82*	*5.67*	*3.27*	*2.10*	*3.67*
$NMFG^2$	-0.004	-0.013**	-0.135**	-0.101**	-0.004	-0.010**
	-0.62	*-2.44*	*-3.74*	*-2.13*	*-1.58*	*-2.88*
PEMP	0.059	0.102*	0.015	0.079	0.014	0.056
	1.53	*1.70*	*0.20*	*0.61*	*0.62*	*1.51*
PCOMP	-0.107	-2.383	-1.673**	-2.956**	-0.038	-0.380
	-0.08	*-1.29*	*-3.031*	*-2.60*	*-0.08*	*-0.43*
MMKT	10.697**	19.511**	3.897	26.010**	9.627**	22.587**
	2.48	*4.06*	*1.01*	*5.55*	*4.71*	*7.33*
R Square	.755	.858	.827	.867	.608	.744
F Value	3.619	7.104	12.972	17.601	7.673	14.389
Number of Observations	38	38	64	64	102	102

a/ Regression coefficient and t-value (in italics)
* Coefficient significant at 90 percent confidence level.
** Coefficient significant at 95 percent confidence level.

tive coefficient as did EMP/POP, implying real estate loans are more frequently obtained from banks near the place of residence rather than place of employment.

SMSA real estate loan demand was directly affected by POP, MFY, NMFG, and MMKT, and inversely related to MFG. AGE significantly entered the 1968 SMSA regression with a positive sign, but did not enter the other runs significantly. MILP was positively related to demand.

Chow Test Results

For the parameter estimates obtained in the six sets of demand regressions to be useful in estimating future demand patterns, the structure parameters must either be constant over time or change in a predictable manner. Since variations in signs and significance levels of coefficients in each demand equation occurred as described above, further analysis was necessary to determine whether these changes were significant.

Chow tests were conducted for each set of demand regressions to test the null hypotheses that the sets of coefficient estimates were equal in 1962 and 1968 within each subarea.[87/] The calculated Chow F and results are given in Table 20.

87/ See Gregory C. Chow, "Tests of Equality Between Sets of Coefficients in Two Linear Regressions," Econometrica, Vol. 28, No. 3 (July, 1960), pp. 591-605.

TABLE 20

CHOW TESTS FOR EQUALITY OF COEFFICIENTS
IN 1962 AND 1968 REGRESSIONS

Demand Equation	Calculated Chow F	At 99 Percent Confidence Level Coefficients Are:
Total Assets		
Chicago	0.88	equal
Suburbs	2.07	equal
SMSA	2.01	equal
Commercial & Industrial Loans		
Chicago	1.00	equal
Suburbs	2.78	different
SMSA	1.86	equal
IPC Demand Deposits		
Chicago	2.05	equal
Suburbs	2.40	different
SMSA	3.19	different
Savings Deposits		
Chicago	0.79	equal
Suburbs	1.70	equal
SMSA	1.15	equal
Loans to Individuals		
Chicago	0.45	equal
Suburbs	2.47	different
SMSA	1.59	equal
Real Estate Loans		
Chicago	1.58	equal
Suburbs	2.95	different
SMSA	3.94	different

The Chow F tests indicated that total asset and savings deposit demand equations within each of the three subareas were equal in 1962 and 1968. Demand for all six services at Chicago banks were the same in the two years, as were SMSA demands for business loans and loans to individuals.

Demand equation coefficients differed for the three types of loans and IPC demand deposits in the suburban runs, and for real estate loans and IPC demand deposits in the SMSA runs. As implied in the regression results, customers do not immediately establish new banking ties as they move from the central city to the suburbs. The static model used here did not specify this dynamic adjustment process. Since the suburbs are the most rapidly growing areas of the SMSA, the cross section regressions may reflect different points on the long run path.

Chow tests were also run to determine whether the demand equation coefficients were equal in the Chicago and Suburban areas for each year. These results are described in Table 21.

TABLE 21

CHOW TESTS FOR EQUALITY OF COEFFICIENTS IN CHICAGO AND SUBURB REGRESSIONS

Demand Equation	Calculated Chow F	At 99 Percent Confidence Level Coefficients Are:
Total Assets		
1962	1.98	equal
1968	4.25	different
Commercial & Industrial Loans		
1962	2.28	different
1968	2.85	different
IPC Demand Deposits		
1962	2.16	equal
1968	4.33	different
Savings Deposits		
1962	3.09	different
1968	3.09	different
Loans to Individuals		
1962	2.85	different
1968	2.43	different
Real Estate Loans		
1962	3.80	different
1968	3.29	different

Except for the 1962 total asset and IPC demand deposit regressions, the null hypotheses that the Chicago and suburb regression coefficients were equal was rejected. This further indicates that the dynamic changes in the SMSA exhibit lagged responses which cannot be described in this static model.

Summary

In summary, commercial banking activity in the Chicago SMSA was heavily concentrated in Loop banks. The percentages of dollar volumes of bank activity in Loop banks ranged from 85 percent for commercial and industrial loans to 30 percent for real estate loans. A central place hierarchy of bank services was evident in that more special services and services used by business firms were more concentrated in the Loop than were services demanded primarily by households.

Despite continued decentralization of SMSA economic activity Loop banks continued to maintain their share of SMSA bank deposits and loans. Between 1962 and 1968, Loop banks actually increased their share of total assets, real estate loans, and commercial and industrial loans. The banks showing the greatest decline in SMSA share were Chicago banks not located in the Loop.

Least squares regressions were run to estimate demand equations for six bank services: total assets, to indicate combined demand for all bank services; commercial and industrial loans; IPC demand deposits; savings deposits; loans to individuals; and real estate loans. All of the hypothesized determinants of demand were significant in at least one of the demand equations.

Regressions for each service were run for Chicago subareas, suburbs, and these two areas combined, SMSA, for both 1962 and 1968.

Results for the Chicago runs were generally poorer than the other two areas in that most demographic variables were not significant. The bank size variable, which was included to capture the fact that large banks serve customers in a wide geographic area, was the most important explanatory variable in the Chicago runs.

All variables generally had the hypothesized size when they entered significantly: population, income, percentage of the population 18 to 64 years of age, miles to the Loop, nonmanufacturing employment, bank size, and employment in adjacent areas had positive demand effects; banks in adjacent areas had a negative effect. The ratio of employment to population had a negative coefficient, implying persons tend to bank where they live rather than work. Population growth had a positive effect on demands at Chicago banks and a negative effect on demands at suburban banks, implying that a lag existed in the short run between the customers' move to the suburbs and their establishment of new banking ties.

Manufacturing employment had a negative coefficient in the demand equations, opposite the hypothesized sign. It was hypothesized that this may reflect the greater prevalence of credit unions in these types of firms. Percentage of the population nonwhite had a significant positive effect on demand deposit and business loan demands and a negative effect on savings deposit demand. The positive NWHT coefficient may reflect the fact that nonwhite population tends to be concentrated in older industrial districts, and thus this variable may reflect business demands.

The applicability of the results were limited by the lack of good measures of bank competition and business firm demands and the inequality of the regression coefficients in the Chicago and SMSA runs, implying one or both areas may have been in short run disequilibrium as adjustments were made in response to new distributions of SMSA economic activity.

CHAPTER V

CONCLUSIONS AND IMPLICATIONS

The purpose of this study was to develop a model of the distribution of commercial banking activity within metropolitan areas, and to determine if the model could be used successfully to describe present and future patterns of commercial bank activity. The model was developed in Chapter II using the well-known theories of consumer maximizing behavior and spatial economic theory.

Estimation of the entire system of simultaneous equations which described the model was not found possible because of the lack of data describing banks' production decisions. While successful demand estimates were possible, information on bank costs and production functions would have greatly increased the information derived from the model. The location of banks in the SMSA should have important effects on the costs of building and land, wage rates, and the amount of competition they face from other banks and financial institutions.

Conclusions based on the regression analysis and its implications for the future pattern of commercial banking in metropolitan areas, and the applicability of the model for use by bank regulatory agencies are described in the remainder of the chapter.

Conclusions of Demand Estimations

Estimations of demand for six bank services indicated that characteristics of the suburbs or city neighborhoods around a bank have an important influence on demand for a bank's services. The effects of the hypothesized determinants of demand may be summarized as follows:

1. Population within the subarea and adjacent areas had strong positive effects on demand for all bank services.

2. Median family income was directly related to demand for each bank service considered.

3. The greater the proportion of residents 18 to 64 years of age, the greater the demands for all bank services.

4. The number of nonmanufacturing employees in the subarea was directly related to demand.

5. The level of manufacturing employment was an insignificant or a negative influence on demand. This was opposite to the hypothesized effect and likely reflects two factors. First, banks compete with employee's credit unions for individuals' accounts. Secondly, manufacturing firms do not consider convenience a factor in choice of bank, and they are more likely to require large amounts of credit that only major banks can easily provide.

6. Employment in adjacent subareas had a positive effect on demand for all services except savings deposits, where its influence was insignificant.

7. The greater the number of bank competitors in adjacent areas, the smaller the demand for services at an area's banks.

8. Large banks attracted customers from wider geographic areas.

9. The greater the distance from the Loop, the greater demand for services of neighborhood banks, except for savings accounts where distance from the Loop was not a significant determinant of demand.

10. The ratio of employment to population in an area had a significant negative coefficient in three demand equations: total assets, real estate loans, and IPC demand deposits. This indicated that persons obtain these services from banks closer to their homes than to their workplaces.

11. The percentage of population nonwhite had an inverse relation with savings account demand, implying the two racial groups had different savings habits. For three services, race was not significant, and for two services, demand deposits and business loans, a positive relation existed. It was concluded that in the latter two equations NWHT may be serving as a proxy measure of business demands.

12. The population growth variables generally had negative coefficients, especially in suburb regressions, implying that a lag exists in the formation of banking ties after economic units change their locations. However, growth in adjacent areas exerted a positive affect on total asset, demand deposit and real estate loan demands in Chicago areas and on business loan demands in the SMSA regression.

Bank competition was a hypothesized positive influence on bank service demands since public awareness of bank services through advertising campaigns and better prices and quality of services were likely to occur where competition was strongest. However, competition was measured by number of banks and this was found to also capture supply effects. Since evidence exists that competition does affect bank behavior, further analysis should be undertaken within the context of this model once a satisfactory measure of competition can be obtained.

Another point for further research arises from lack of data. Characteristics of an area's business firms could be measured only by employment. The weaknesses of this proxy variable were pointed out, and the regression results strengthened the case for obtaining better measures of factors affecting business firms' demands. The characteristics of the population were significant determinants of business loan demands, probably because zoning laws, agglomerative economies, and other factors tend to find certain types of firms and households located together. The results of demand estimates of businesses obtained here should be interpreted with caution.

The Future Pattern of Commercial Banking in Metropolitan Areas

Results of Chow tests indicated that the estimated structure equations differed between Chicago and suburban areas. This implied that the observed levels of banking services provided in one or both of the areas were not long run equilibrium levels. Chow tests indicated that the Chicago demand regressions were equal in 1962 and 1968, but that changes had occurred in demand for suburban bank services, except for savings accounts and total assets. The signs of the population growth coefficients in the regressions, implied that a lag existed before former Chicago residents established new banking ties in the suburbs.

Further quantification of the nature of the lag in adjustments of demands for bank services to relocation of economic units was not possible. Time series analysis would be required to determine this relationship, and such data were not available at the time this study was begun. Future research in this area would be possible in that semi-annual Reports of Condition of banks are now available from 1959 to the present.

The lack of significance of most demographic variables in Chicago demand equations and the strong positive influence of the bank size variable implied that only larger Chicago banks, which are able to meet demands for more specialized services and larger credit amounts, will continue to prosper. The smaller banks, that rely almost entirely on small business and household accounts, will find demands for their services continuing to decline as their customers move to the suburbs and poorer residents take their place. The lack of significance of most demographic variables in Chicago regressions implied that these banks were relying on older customer relations. A more definite central hierarchy of bank services will likely evolve. Since the customers served by the larger banks will not consider convenience as important a factor in bank choice, these large banks will be freer to choose an optimal location based on minimum operating costs. Without adequate bank cost data, this new distribution cannot be determined.

The ability of smaller Chicago banks to grow may be enhanced by the changes in bank technology that are presently underway and that are likely to occur in the next few years. Banks are becoming more dependent on computers to process checks, loan payments, etc. Computer technology has advanced to the point where even small banks frequently use off-premise computers to process accounts, thereby minimizing cost differences between large and small banks.

In the future, the whole nature of the payments mechanism will change drastically. Already, charge cards are being used for more purchases and banks are allowing customers to write one check which authorizes the bank to pay several utilities, department stores, and other creditors for the customer. Experiments are underway where all wages are directly transferred to the employee's bank account. Others enable persons to use a type of credit card when they purchase goods by which the merchant, through a remote terminal hook up with a bank, can transfer funds immediately to the merchant's account from the customer's account. A universal electronic funds transfer system is not far in the future; California banks are ready to implement the first step to create such a system, and Japan plans to have such a nationwide computer system operational in 1973. To the extent that small Chicago banks are not able to afford the new technological equipment, they will further be at a disadvantage.

Possible Uses of the Model by Bank Regulatory Agencies

Various regulatory agencies are charged with approving new bank and branch applications, bank mergers, and holding company acquisitions. Without information on bank costs and competition and due to the differences in the estimated structure equations between Chicago and suburb areas, implications for these regulatory agencies are limited. However, the results of this study provide these tentative guidelines:

1. Banks in central cities of SMSAs should be permitted to establish branches or relocate in the growing suburban areas. These banks will not be in a favorable position to compete for business of households and smaller firms that move to the suburbs.

2. Banks with assets over $100 million serve customers outside of their community areas.

3. If some minimal efficient size of bank operations is defined, data available from censuses and state employment offices can be used to determine if an additional bank or office will be able to obtain efficient operating size. While free entry would be preferable, the prevailing state laws and belief that "overbanking" is dangerous should at least be quantified, so that a model such as developed here can be used to provide better administration of the law.

APPENDIX A

DATA SOURCES AND COMPUTATION

The subareas of observation included in this study were the 75 community areas of the City of Chicago defined in the Local Community Fact Book - Chicago Metropolitan Area, 1960[1/] and the 66 suburbs in the Chicago Standard Metropolitan Statistical Area (SMSA) which had a population of at least 10,000 in 1960. Bank data were total dollar amounts of accounts at all commercial banks within each subarea. Banks were assigned to their subareas by street addresses obtained from Rand McNally International Banker's Directory.[2/] The dollar amounts of loans, deposits, and assets were provided from the Reports of Condition filed by all commercial banks for December 31, 1962 and December 31, 1968.

Potential variables were calculated as the sum of the observations on adjacent subareas, weighted by mileage between their

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1/ Evelyn M. Kitagawa and Karl E. Taeuber, eds., Local Community Fact Book - Chicago Metropolitan Area, 1960 (Chicago: Chicago Community Inventory, University of Chicago, 1963). The Chicago community area which encompasses O'Hare Airport was excluded. The data compiled in this publication were derived from U.S. Census reports.

2/ Rand McNally International Banker's Directory, First 1963 and First 1969 Editions (Chicago: Rand McNally & Company, 1963 and 1969).

geographic centers, d_{nj}; *e.g.* $PPOP_n = \sum_{j=1}^{J} \frac{POP_j}{d_{nj}}$, J = number of adjacent areas. However, for potential growth, PPOPGR, the simple arithmetic mean annual rate of growth of adjacent subareas was used.

Employment data for 1968 were compiled from published reports of the Chicago Area Labor Market Analysis Unit of the Illinois Bureau of Labor Security. Similar data for 1962 were obtained directly from the same office.[3/]

The percentage of the population between 18 and 64 years of age was obtained from the *Local Community Fact Book*. The 1960 percentages were used for both 1962 and 1968 demand equation estimations since no data were available between census years.

Population, median family income, and percentage of the population nonwhite were estimated for 1962 and 1968 using data for 1960 in the *Local Community Fact Book* and 1966 estimates of the Hospital Planning Council.[4/] The compound annual rates of change

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3/ State of Illinois Bureau of Employment Security, Chicago Area Labor Market Analysis Unit, *Employment Covered Under the Illinois Unemployment Compensation Act, 1967-1968, Chicago Standard Metropolitan Statistical Area* (no date).

4/ Chicago Association of Commerce and Industry, Hospital Planning Council for Metropolitan Chicago -- Chicago Regional Hospital Study, "Population Estimates for Municipalities and Counties in the Chicago Consolidated Area: 1965 and 1966" (December 1966) and "Median Family Income in 1966 and the Economic Rank of 250 Communities in Metropolitan Chicago" (April 1967).

of the respective variables between 1960 and 1966 were used to estimate 1962 and 1968 data.

Annual rates of population growth, used in the 1962 regression runs, were those for the decade of the 1950s as given in the Local Community Fact Book. For the 1968 regression runs population growth in the 1960s, estimated for the period 1960 to 1966 by the Hospital Planning Council, was used.[5/]

5/ Chicago Association of Commerce and Industry, "Population Estimates."

APPENDIX B

CHICAGO SMSA SUBAREAS CONSIDERED IN STUDY

Community Areas of Chicago

Albany Park
Archer Heights
*Armour Square
*Ashburn
Auburn Gresham
Austin
*Avalon Park
Avondale
Belmont Cragin
*Beverly
Bridgeport
*Brighton Park
*Burnside
*Calumet Heights
Chatham
Chicago Lawn
Clearing
Douglas
*Dunning
*East Garfield Park
East Side
*Edison Park
Englewood
*Forest Glen
*Fuller Park
*Gage Park
*Garfield Ridge
*Grand Boulevard
*Greater Grand Crossing
*Hegewisch
*Hermosa
Humboldt Park
Hyde Park
*Irving Park
*Jefferson Park
Kenwood
Lake View
Lincoln Park
Lincoln Square
Logan Square
*Loop
Lower West Side
*McKinley Park
*Montclare
*Morgan Park
Mount Greenwood
Near North Side
*Near South Side
Near West Side
New City
North Center
North Lawndale
*North Park
*Norwood Park
*Oakland
Portage Park
*Pullman
*Riverdale
Rogers Park
Roseland
South Chicago
*South Deering
South Lawndale
South Shore
Uptown
Washington Heights
*Washington Park
*West Elsdon
*West Englewood
*West Garfield Park
*West Lawn
*West Pullman
West Ridge
West Town
Woodlawn

* Loop and areas without banks deleted from final set of observations.

Suburban Areas

Arlington Heights	Glen Ellyn	Northbrook
Aurora	Glenview	North Chicago
Bellwood	Harvey	North Lake
Berwyn	Highland Park	Oak Lawn
Blue Island	Hinsdale	Oak Park
Brookfield	Homewood	Palantine
Calumet City	Joliet	Park Forest
*Carpentersville	La Grange	Park Ridge
Chicago Heights	La Grange Park	Riverdale
Cicero	Lake Forest	River Forest
Deerfield	Lansing	Rolling Meadows
Des Plaines	Lincolnwood	Skokie
Dolton	Lombard	South Holland
Downers Grove	Markham	Summit
Elgin	Maywood	Villa Park
Elmhurst	Melrose Park	Waukegan
Elmwood Park	Morton Grove	*Westchester
Evanston	Mt. Prospect	Western Springs
Evergreen Park	Mundelein	Wheaton
Forest Park	Naperville	Wilmette
Franklin Park	Niles	Winnetka
Glencoe	Norridge	Zion

* Loop and areas without banks deleted from final set of observations.

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